GE Medical Systems

Technical Publications

2146692–100

Revision 4

Senographe 700T and 800T sm Service Manual

do not duplicate

ATTENTION

LES APPAREILS À RAYONS X SONT DANGEREUX À LA FOIS POUR LE PATIENT ET POUR LE MANIPULATEUR SI LES MESURES DE PROTECTION NE SONT PAS STRICTEMENT APPLIQUEES

Bien que cet appareil soit construit selon les normes de sécurité les plus sévères, la source de rayonnement X représente un danger lorsque le manipulateur est non qualifié ou non averti. Une exposition excessive au rayonnement X entraîne des dommages à l'organisme.

Par conséquent, toutes les précautions doivent être prises pour éviter que les personnes non autorisées ou non qualifiées utilisent cet appareil créant ainsi un danger pour les autres et pour elles–mêmes.

Avant chaque manipulation, les personnes qualifiées et autorisées à se servir de cet appareil doivent se renseigner sur les mesures de protection établies par la Commission Internationale de la Protection Radiologique, Annales 60 : Recommandations de la Commission Internationale sur la Protection Radiologique et les normes nationales en vigueur.

WARNING

X–RAY EQUIPMENT IS DANGEROUS TO BOTH PATIENT AND OPERATOR UNLESS MEASURES OF PROTECTION ARE STRICTLY OBSERVED

Though this equipment is built to the highest standards of electrical and mechanical safety, the useful x–ray beam becomes a source of danger in the hands of the unauthorized or unqualified operator. Excessive exposure to x–radiation causes damage to human tissue.

Therefore, adequate precautions must be taken to prevent unauthorized or unqualified persons from operating this equipment or exposing themselves or others to its radiation.

Before operation, persons qualified and authorized to operate this equipment should be familiar with the Recommendations of the International Commission on Radiological Protection, contained in Annals Number 60 of the ICRP, and with applicable national standards.

ATENCION

LOS APARATOS DE RAYOS X SON PELIGROSOS PARA EL PACIENTE Y EL MANIPULADOR CUANDO LAS NORMAS DE PROTECCION NO ESTAN OBSERVADAS

Aunque este aparato está construido según las normas de seguridad más estrictas, la radiación X constituye un peligro al ser manipulado por personas no autorizadas o incompetentes. Una exposición excesiva a la radiación X puede causar daños al organismo.

Por consiguiente, se deberán tomar todas las precauciones necesarias para evitar que las personas incompetentes o no autorizadas utilicen este aparato, lo que sería un peligro para los demás y para sí mismas.

Antes de efectuar las manipulaciones, las personas habilitadas y competentes en el uso de este aparato, deberán informarse sobre las normas de protección fijadas por la Comisión Internacional de la Protección Radiológica, Anales No 60: Recomendaciónes de la Comisión Internacional sobre la Protección Radiológica y normas nacionales.

ACHTUNG

RÖNTGENAPPARATE SIND EINE GEFAHR FÜR PATIENTEN SOWIE BEDIENUNGSPERSONAL, WENN DIE GELTENDEN SICHERHEITSVORKEHRUNGEN NICHT GENAU BEACHTET WERDEN

Dieser Apparat entspricht in seiner Bauweise strengsten elektrischen und mechanischen Sichereitsnormen, doch in den Händen unbefugter oder unqualifizierter Personen wird er zu einer Gefahrenquelle. Übermäßige Röntgenbestrahlung ist für den menschlichen Organismus schädlich.

Deswegen sind hinreichende Vorsichtsmaßnahmen erforderlich, um zu verhindern, daßunbefugte oder unqualifizierte Personen solche Geräte bedienen oder sich selbst und andere Personen deren Bestrahlung aussetzen können.

Vor Inbetriebnahme dieses Apparats sollte sich das qualifizierte und befugte Bedienungspersonal mit den geltenden Kriterien für den gefahrlosen Strahleneinsatz durch sorgfältiges Studium des Hefts Nr. 60 der Internationalen Kommission für Strahlenschutz (ICRP) vertraut machen: Empfehlungen der Internationalen Kommission für Strahlenschutz und anderer nationaler Normenbehörden.

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WARNING

- **THIS SERVICE MANUAL IS AVAILABLE IN ENGLISH ONLY.**
- **IF A CUSTOMER'S SERVICE PROVIDER REQUIRES A LANGUAGE OTHER THAN ENGLISH, IT IS THE CUSTOMER'S RESPONSIBILITY TO PROVIDE TRANSLATION SERVICES.**
- **DO NOT ATTEMPT TO SERVICE THE EQUIPMENT UNLESS THIS SERVICE MANUAL HAS BEEN CONSULTED AND IS UNDERSTOOD.**
- **FAILURE TO HEED THIS WARNING MAY RESULT IN INJURY TO THE SERVICE PROVIDER, OPERATOR OR PATIENT FROM ELECTRIC SHOCK, MECHANICAL OR OTHER HAZARDS.**

AVERTISSEMENT

- **CE MANUEL DE MAINTENANCE N'EST DISPONIBLE QU'EN ANGLAIS.**
- **SI LE TECHNICIEN DU CLIENT A BESOIN DE CE MANUEL DANS UNE AUTRE LANGUE QUE L'ANGLAIS, C'EST AU CLIENT QU'IL INCOMBE DE LE FAIRE TRADUIRE.**
- **NE PAS TENTER D'INTERVENTION SUR LES ÉQUIPEMENTS TANT QUE LE MANUEL SERVICE N'A PAS ÉTÉ CONSULTÉ ET COMPRIS.**
- **LE NON-RESPECT DE CET AVERTISSEMENT PEUT ENTRAÎNER CHEZ LE TECHNICIEN, L'OPÉRATEUR OU LE PATIENT DES BLESSURES DUES À DES DANGERS ÉLECTRIQUES, MÉCANIQUES OU AUTRES.**

WARNUNG

- **DIESES KUNDENDIENST–HANDBUCH EXISTIERT NUR IN ENGLISCHER SPRACHE.**
- **FALLS EIN FREMDER KUNDENDIENST EINE ANDERE SPRACHE BENÖTIGT, IST ES AUFGABE DES KUNDEN FÜR EINE ENTSPRECHENDE ÜBERSETZUNG ZU SORGEN.**
- **VERSUCHEN SIE NICHT, DAS GERÄT ZU REPARIEREN, BEVOR DIESES KUNDENDIENST–HANDBUCH NICHT ZU RATE GEZOGEN UND VERSTANDEN WURDE.**
- **WIRD DIESE WARNUNG NICHT BEACHTET, SO KANN ES ZU VERLETZUNGEN DES KUNDENDIENSTTECHNIKERS, DES BEDIENERS ODER DES PATIENTEN DURCH ELEKTRISCHE SCHLÄGE, MECHANISCHE ODER SONSTIGE GEFAHREN KOMMEN.**

AVISO

- **ESTE MANUAL DE SERVICIO SÓLO EXISTE EN INGLÉS.**
- **SI ALGÚN PROVEEDOR DE SERVICIOS AJENO A GEMS SOLICITA UN IDIOMA QUE NO SEA EL INGLÉS, ES RESPONSABILIDAD DEL CLIENTE OFRECER UN SERVICIO DE TRADUCCIÓN.**
- **NO SE DEBERÁ DAR SERVICIO TÉCNICO AL EQUIPO, SIN HABER CONSULTADO Y COMPRENDIDO ESTE MANUAL DE SERVICIO.**
- **LA NO OBSERVANCIA DEL PRESENTE AVISO PUEDE DAR LUGAR A QUE EL PROVEEDOR DE SERVICIOS, EL OPERADOR O EL PACIENTE SUFRAN LESIONES PROVOCADAS POR CAUSAS ELÉCTRICAS, MECÁNICAS O DE OTRA NATURALEZA.**

ATENÇÃO

- **ESTE MANUAL DE ASSISTÊNCIA TÉCNICA SÓ SE ENCONTRA DISPONÍVEL EM INGLÊS.**
- **SE QUALQUER OUTRO SERVIÇO DE ASSISTÊNCIA TÉCNICA, QUE NÃO A GEMS, SOLICITAR ESTES MANUAIS NOUTRO IDIOMA, É DA RESPONSABILIDADE DO CLIENTE FORNECER OS SERVIÇOS DE TRADUÇÃO.**
- **NÃO TENTE REPARAR O EQUIPAMENTO SEM TER CONSULTADO E COMPREENDIDO ESTE MANUAL DE ASSISTÊNCIA TÉCNICA.**
- **O NÃO CUMPRIMENTO DESTE AVISO PODE POR EM PERIGO A SEGURANÇA DO TÉCNICO, OPERADOR OU PACIENTE DEVIDO A‘ CHOQUES ELÉTRICOS, MECÂNICOS OU OUTROS.**

AVVERTENZA

- **IL PRESENTE MANUALE DI MANUTENZIONE È DISPONIBILE SOLTANTO IN INGLESE.**
- **SE UN ADDETTO ALLA MANUTENZIONE ESTERNO ALLA GEMS RICHIEDE IL MANUALE IN UNA LINGUA DIVERSA, IL CLIENTE È TENUTO A PROVVEDERE DIRETTAMENTE ALLA TRADUZIONE.**
- **SI PROCEDA ALLA MANUTENZIONE DELL’APPARECCHIATURA SOLO DOPO AVER CONSULTATO IL PRESENTE MANUALE ED AVERNE COMPRESO IL CONTENUTO.**
- **NON TENERE CONTO DELLA PRESENTE AVVERTENZA POTREBBE FAR COMPIERE OPERAZIONI DA CUI DERIVINO LESIONI ALL’ADDETTO ALLA MANUTENZIONE, ALL’UTILIZZATORE ED AL PAZIENTE PER FOLGORAZIONE ELETTRICA, PER URTI MECCANICI OD ALTRI RISCHI.**

警告

・このサービスマニュアルには英語版しかありません。
・ＧＥＭＳ以外でサービスを担当される業者が英語以外の言語を要求される場合、翻訳作業はその業者の責任で行うものとさせていただきます。
・このサービスマニュアルを熟読し理解せずに、装置のサービスを行わないで下さい。
・この警告に従わない場合、サービスを担当される方、操作員あるいは患者さんが、感電や機械的又はその他の危険により負傷する可能性があります。

注意:

- 本维修手册仅存有英文本。
- 非 GEMS 公司的维修员要求非英文本的维修手册时，客户需自行负责翻译。
- 未详细阅读和完全了解本手册之前，不得进行维修。
- 忽略本注意事项会对维修员，操作员或病人造成触电，机械伤害或其他伤害。

REVISION HISTORY

REV	DATE	REASON FOR CHANGE
0	Mar. 12, 1996	Initial release
1	April 24, 1996	Update.
2	Jan 17, 1997	Update.
3	March 12, 2001	SPR BUCge54596 (addition of conduite chimney) SPR BUCge25516 (update of Spare Part List) SPR BUCge56785 (update of Spare Part List)
4	May 28, 2001	**PROGRAM “SAPPHIRE M3** – SPR BUCge64798. ”Addition of Job Cards IST011B, CAL007B, CAL013B, CAL014B, CAL050 (used with CAL007 9–parameter software, i.e. >= V2.31). Old Job Cards IST011, CAL007, CAL013, CAL014 become Job Cards IST011A, CAL007A, CAL013A and CAL014A (used with CAL007 6–parameter software, i.e. <= V2.21). Update of Job Cards CAL005 and CAL022. Illustrations 1–12 and 1–13 are breakdown into 1–12A ; 1–13A (for software <= V2.21) and 1–12B; 1–13B (for software >= V2.31). Addition of 1–12C (GAMMA MODEL MENU) Steering Guide (illustration 1–17) is breakdown into 1–17A illustration (for software <= V2.21) and 1–17B illustration (for software >= V2.31). Addition of Job Card CAL051–8 OD Optimization in Magnification Mode (for IEC compliance).

LIST OF EFFECTIVE PAGES

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CHAPTER 1 – INSTALLATION

SECTION 1
INTRODUCTION

1–1 Chapter Overview

This chapter presents the Senographe installation procedures. The wiring and room layout requirements for the product are covered in the Pre–Installation Manual.

1–2 Inspection for Damage

The Senographe was completely inspected for proper operation and appearance before shipment. However, it is necessary to inspect the product after the shipment is received. Visually inspect the packages for any apparent damage. If there are signs of damage, refer to the **Damage in Transportation** statement in the front of this manual.

Open the packages and refer to the Product Delivery Instructions (PDI). Verify that items on the list are present in the package. Carefully examine the contents for small parts.

SECTION 2
DESCRIPTION OF DELIVERED EQUIPMENT

See Pre–Installation Manual for description of delivered equipment.

SECTION 3
HOW TO USE THE CONSOLE IN INSTALLATION MODE

3–1 Introduction

This section describes how to use the Senographe console during product installation.

3–2 Application vs. Installation

Throughout the Senographe documentation, reference is made to the ”application” mode, as opposed to the ”installation” mode, in order to differentiate between normal operation of the product by a doctor and operation of the product during installation.

Each time the Senographe is turned on, the software automatically starts up in the ”application” mode.

For information on using the Senographe in application mode, see Operator Manual.

One Senographe assembly must be installed. Therefore, there are two separate installation modes, one for the generator and one for the gantry. See Section 3–4.

3–3 Description of the Console

Illustration 1–1 shows the console. When the Senographe is in application mode, contains keys below the display window correspond to the functions that their respective symbol markings. See Operator Manual.

On the other hand, when the Senographe is in installation mode, the function of each of these six keys depends on the procedure being performed and is displayed on the bottom line of the display window, adjacent to the corresponding key.

To enter installation mode, press the **SETUP** key once. To return immediately to application mode, press the **SETUP** key again.

Illustration 1–2 shows the console before and after entry into the installation mode. Section 1 of this illustration shows a typical console display during normal application mode use. Section 2 shows the appearance of the display window after, starting from application mode, the **SETUP** key is pressed once.

ILLUSTRATION 1–1
SENOGRAPHE CONSOLE

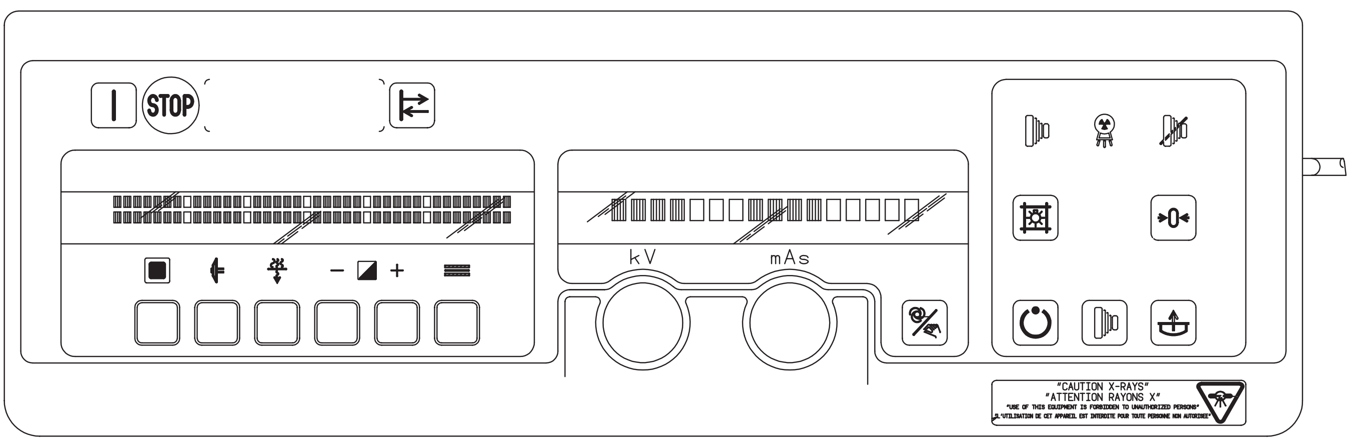
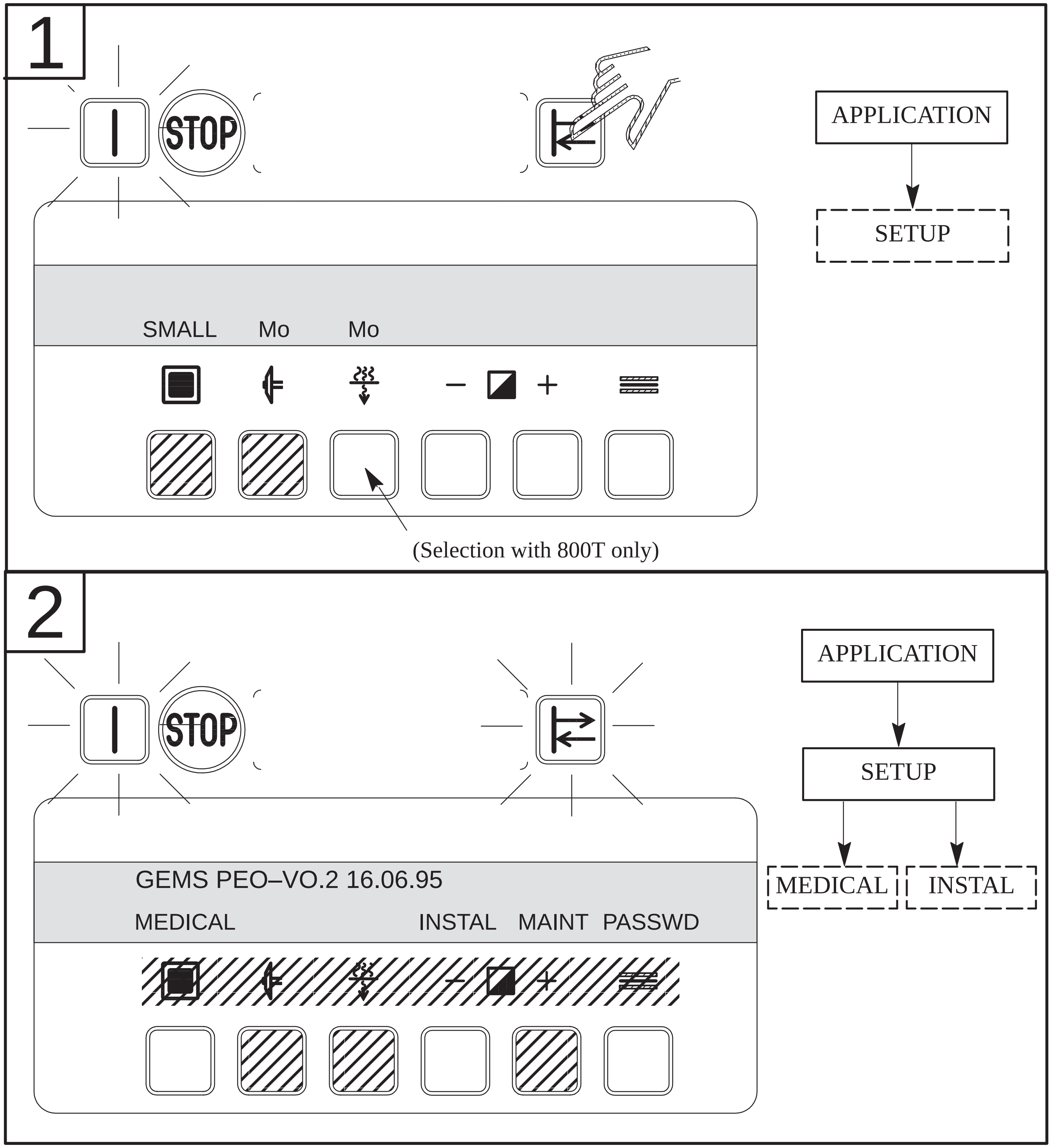


ILLUSTRATION 1–2

CONSOLE DISPLAY BEFORE (1) AND AFTER (2) SETUP KEY IS PRESSED ONCE STARTING FROM APPLICATION MODE



3–4 Accessing the Generator and Gantry Installation Mode from the Console

Menu access paths: **SETUP/INSTAL/GENE** OR **SETUP/INSTAL/ARM**

To access the generator and gantry installation mode starting from application mode, follow this sequence:

1. Press the ”SETUP” key  .
2. The ”MAINT” menu is not accessible with the console.
3. Change the position of the installation menu enable switch (switch 8 of B1 on CPU board 300PL4) from its position prior to power–up to the opposite position. See Illustration 1–3. This enables access to the generator and gantry installation menus.

Note: To access to the installation menu you can also select the ”PASSWD” key and compose the password (given at the training course). And press the ”SETUP” key.

4. Select the ”INSTAL” menu.
5. You now have access to the installation menus.

Note: The position of the installation menu enable switch or ”PASSWD” key is memorized each time the Senographe is turned on. Until the machine is again turned off (or the default parameters are re–loaded via the INSTAL ”CLEAR” menu, see Section 3–8), this memorized position will be the ”installation menu access disabled” position, and the opposite position will be the ”installation menu access enabled” position. The significance of the switch’s position at a given moment thus depends upon its position at power–up.

CAUTION

When you have finished using the Senographe installation mode, you must turn off the Senographe before turning over use of the machine to the user. In this way, when the machine is turned on again, access to the installation mode will be automatically locked out. See Note above.

Illustration 1–4 shows the sequence for accessing installation mode.

ILLUSTRATION 1–3
LOCATION OF INSTALLATION MENU ENABLE SWITCH

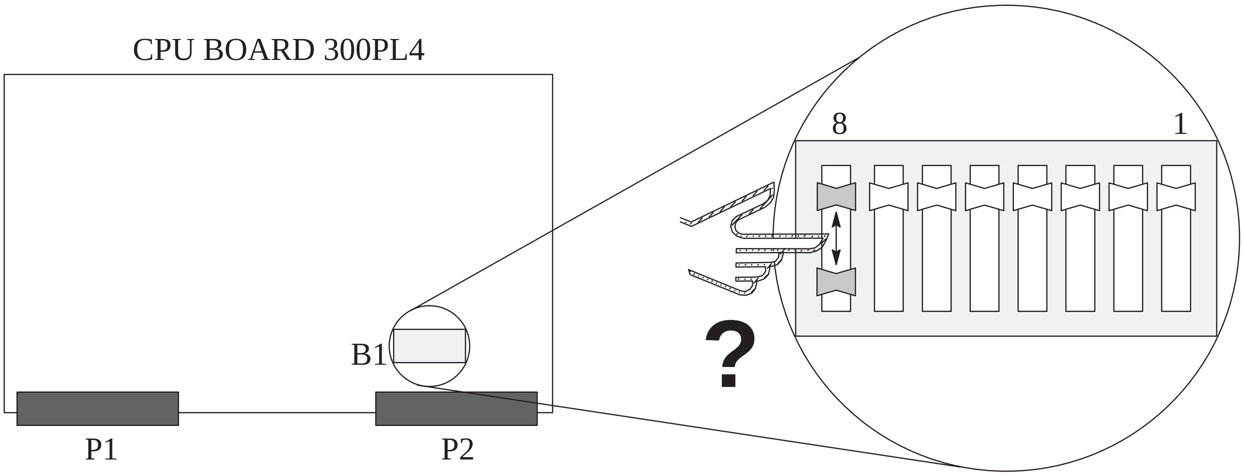


ILLUSTRATION 1–4
SEQUENCE FOR ENTERING INSTALLATION MODE

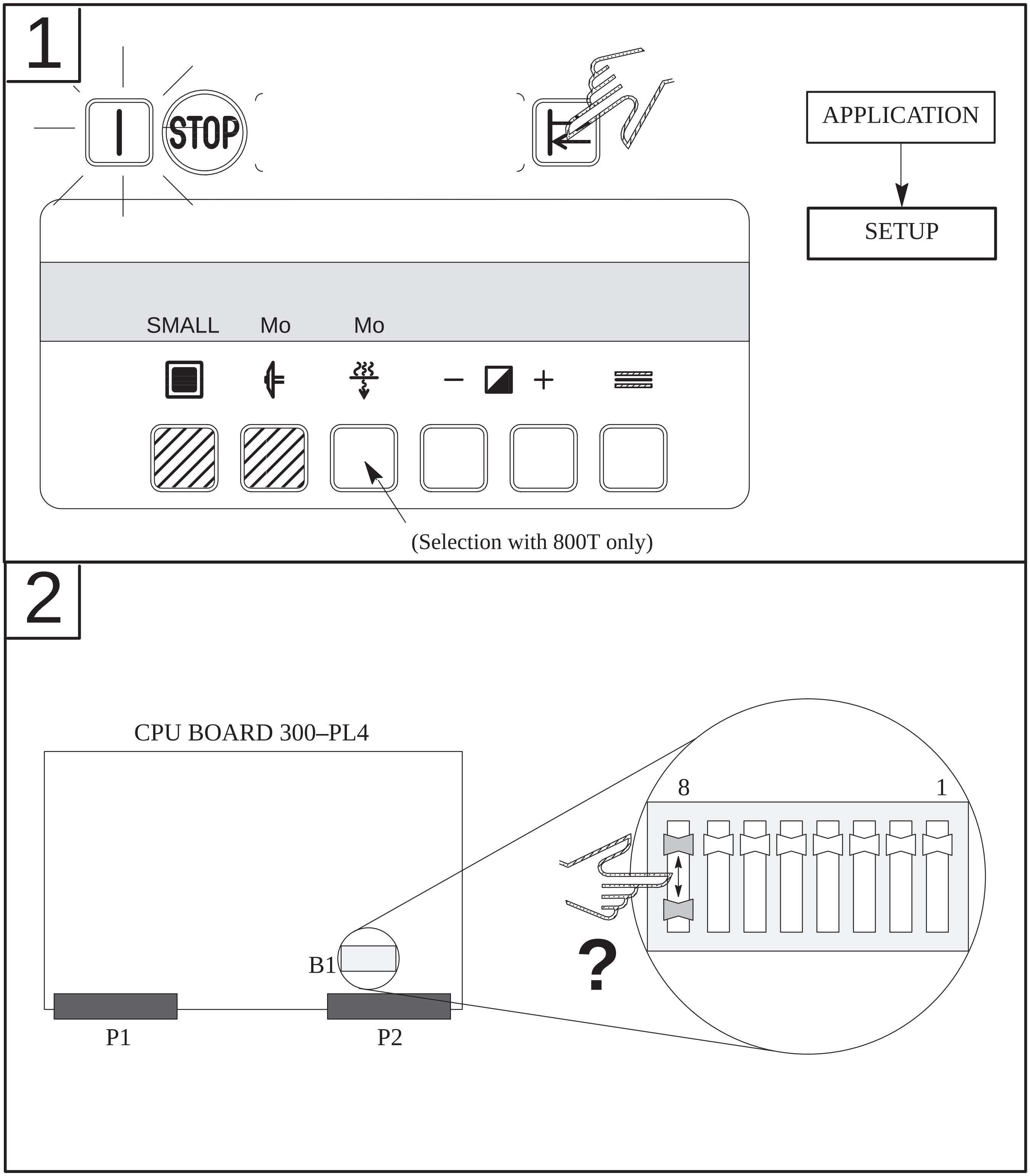
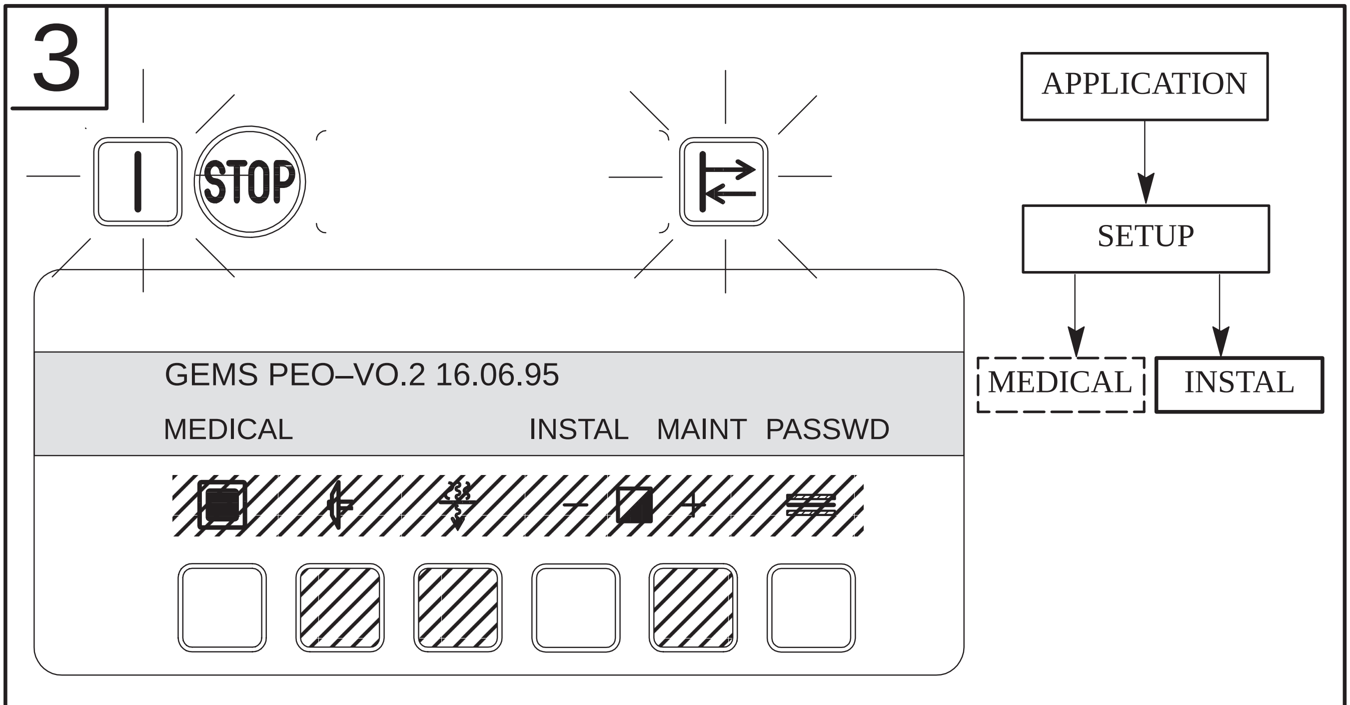
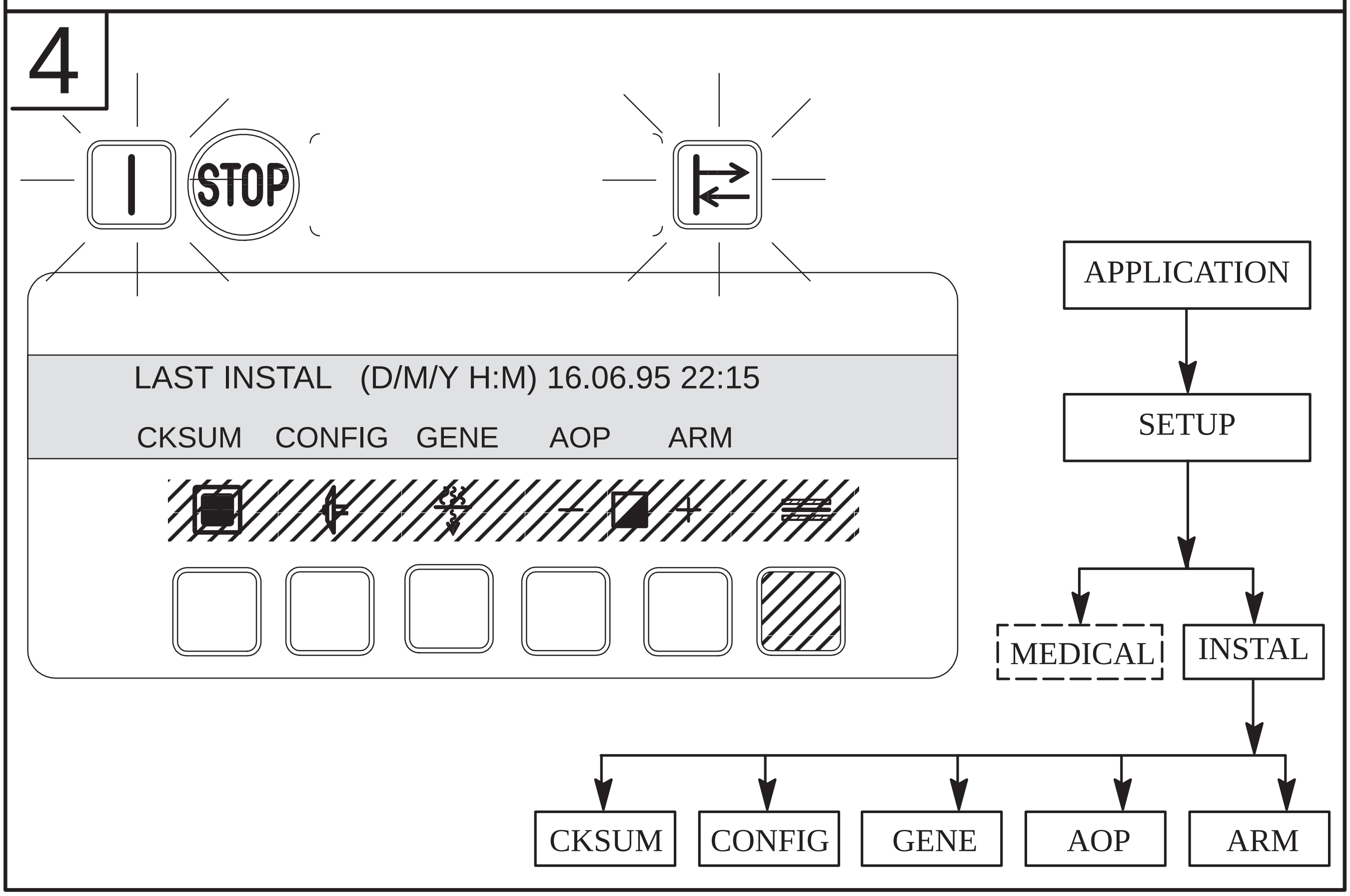


ILLUSTRATION 1–5





3–5 Installation Menu Tree Structure

The various installation menus are accessible via a tree structure. Illustrations 1–6 to 1–15 show this tree structure.

ILLUSTRATION 1–6
INSTALLATION MENU TREE STRUCTURE

KEY

(values) indicates that several values can be displayed by rotating the kV knob.

(value) indicates that a single value is displayed or can be modified or entered.

kV — indicates that rotation of the kV knob will either display other parameter values, or modify a digit or character in a string being entered.

indicates that the 2nd trigger button must be pressed in order to perform the calibration (see associated instructions for the calibration in question before using these menus).

THE SENOGRAPHE 700T & 800T MENU

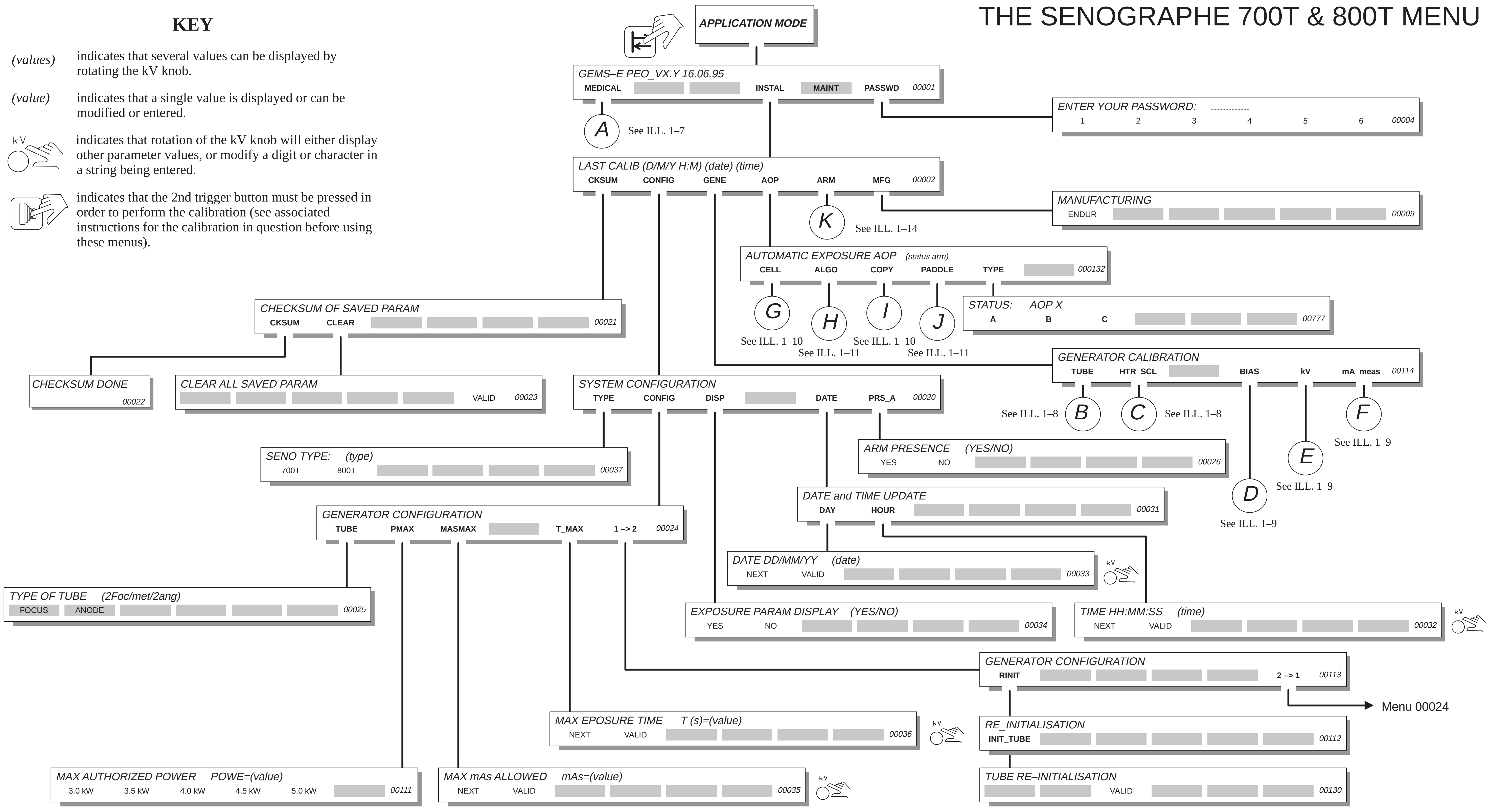


ILLUSTRATION 1–7
INSTALLATION MENU TREE STRUCTURE (cont'd)

KEY

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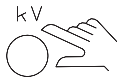

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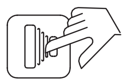
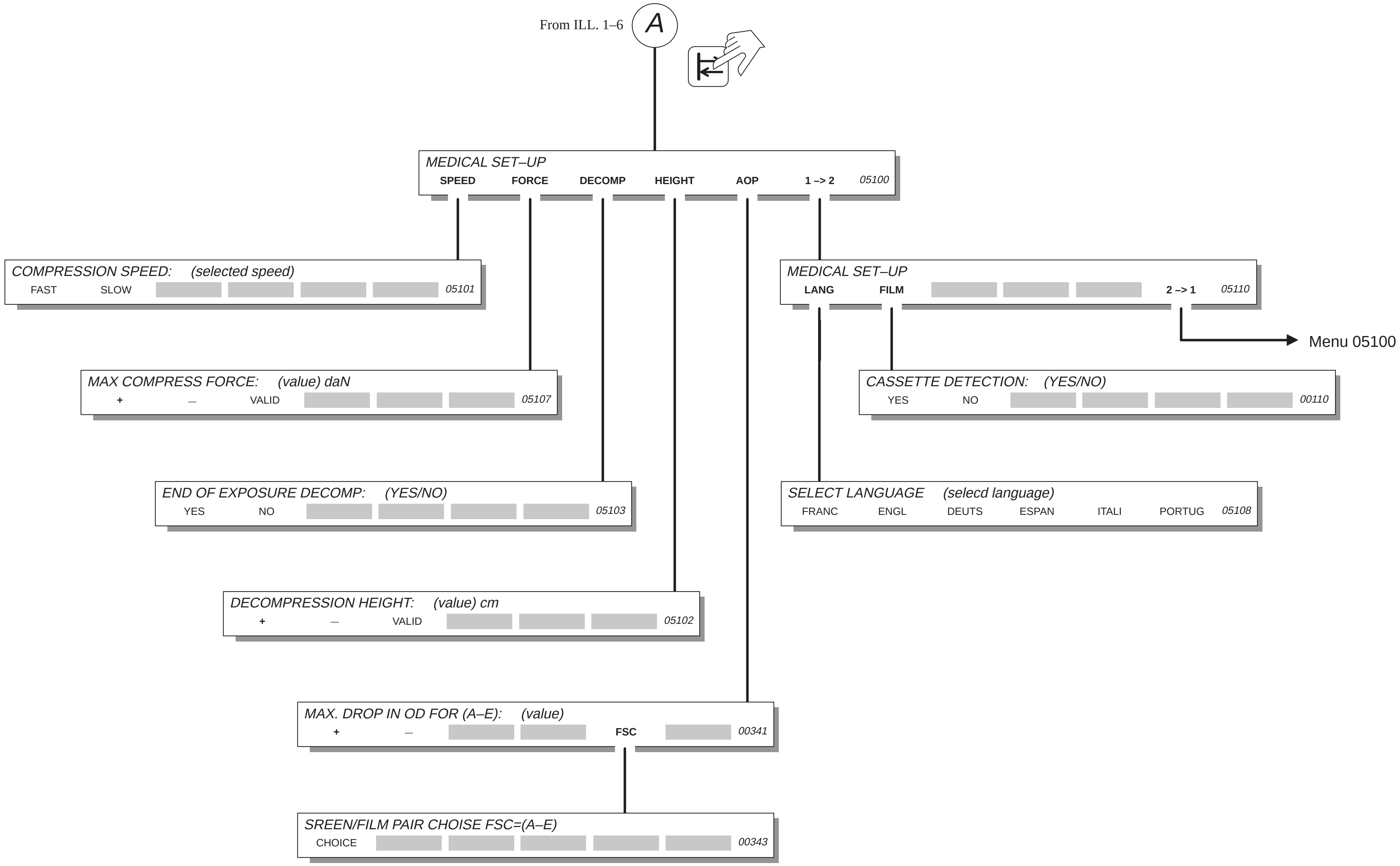

indicates that the 2nd trigger button must be pressed in order to perform the calibration (see associated instructions for the calibration in question before using these menus).

MEDICAL



INSTALLATION

ILLUSTRATION 1–8
INSTALLATION MENU TREE STRUCTURE (cont'd)

KEY

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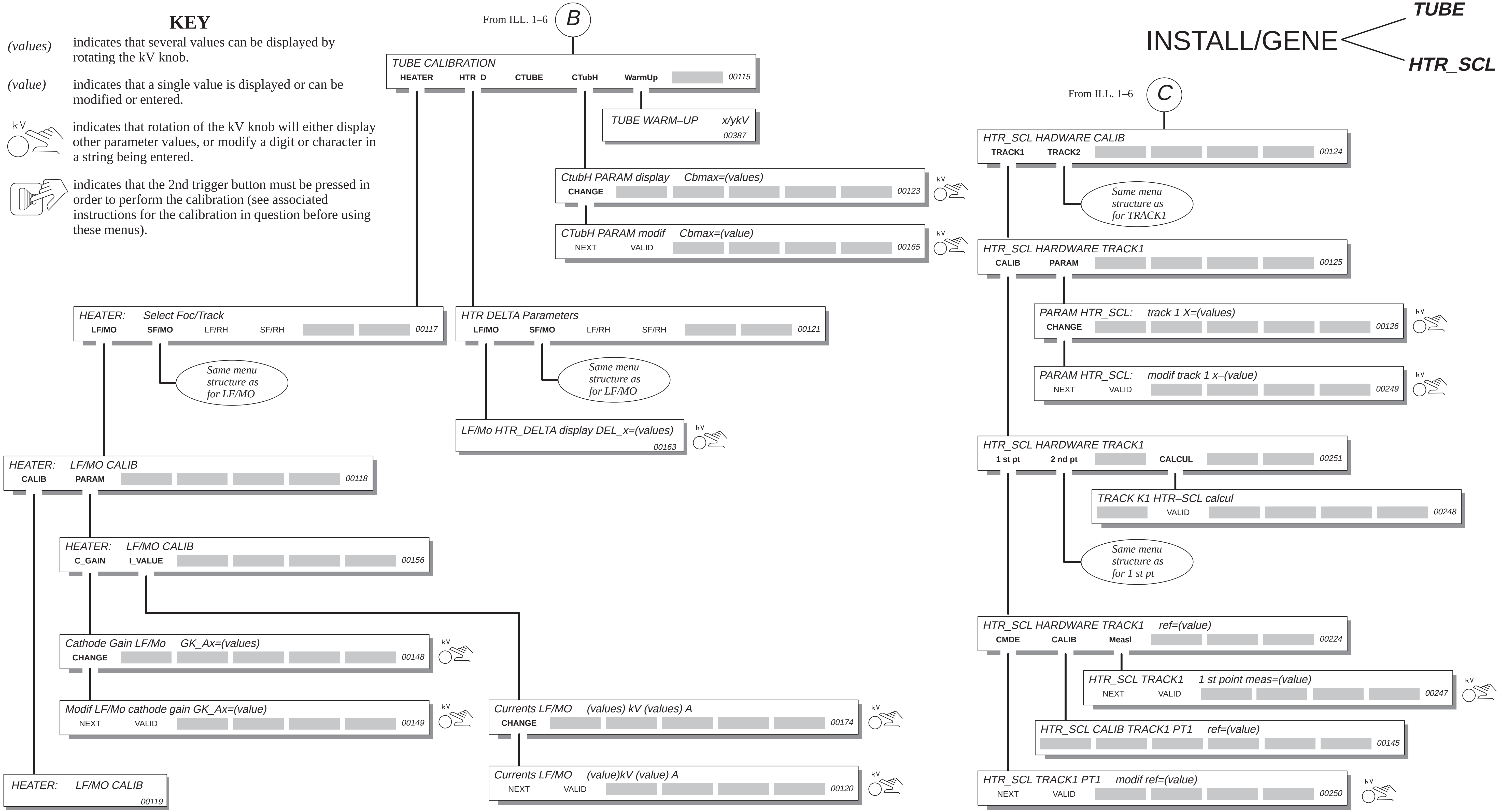

INSTALLATION

ILLUSTRATION 1–9
INSTALLATION MENU TREE STRUCTURE (cont'd)

KEY

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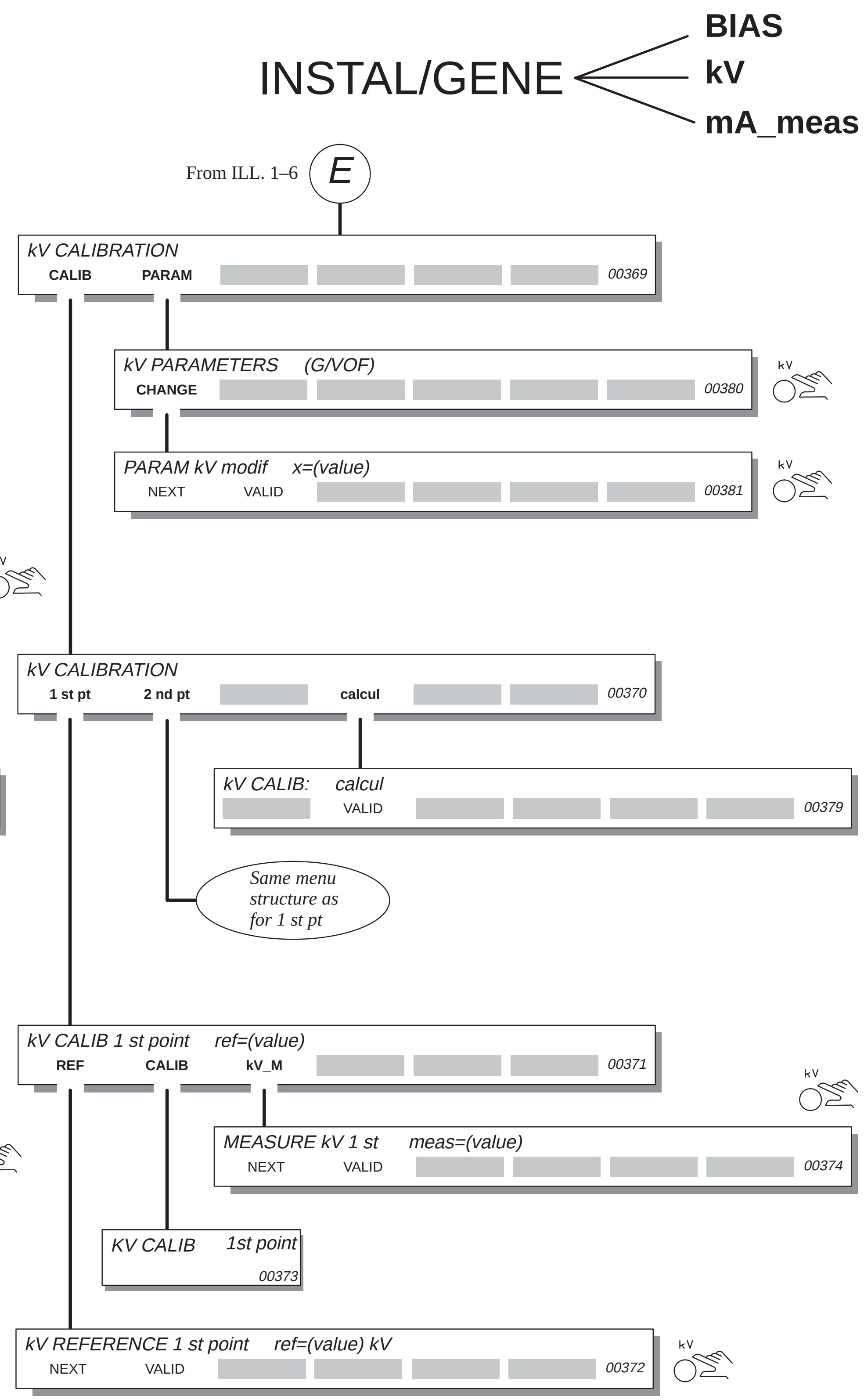

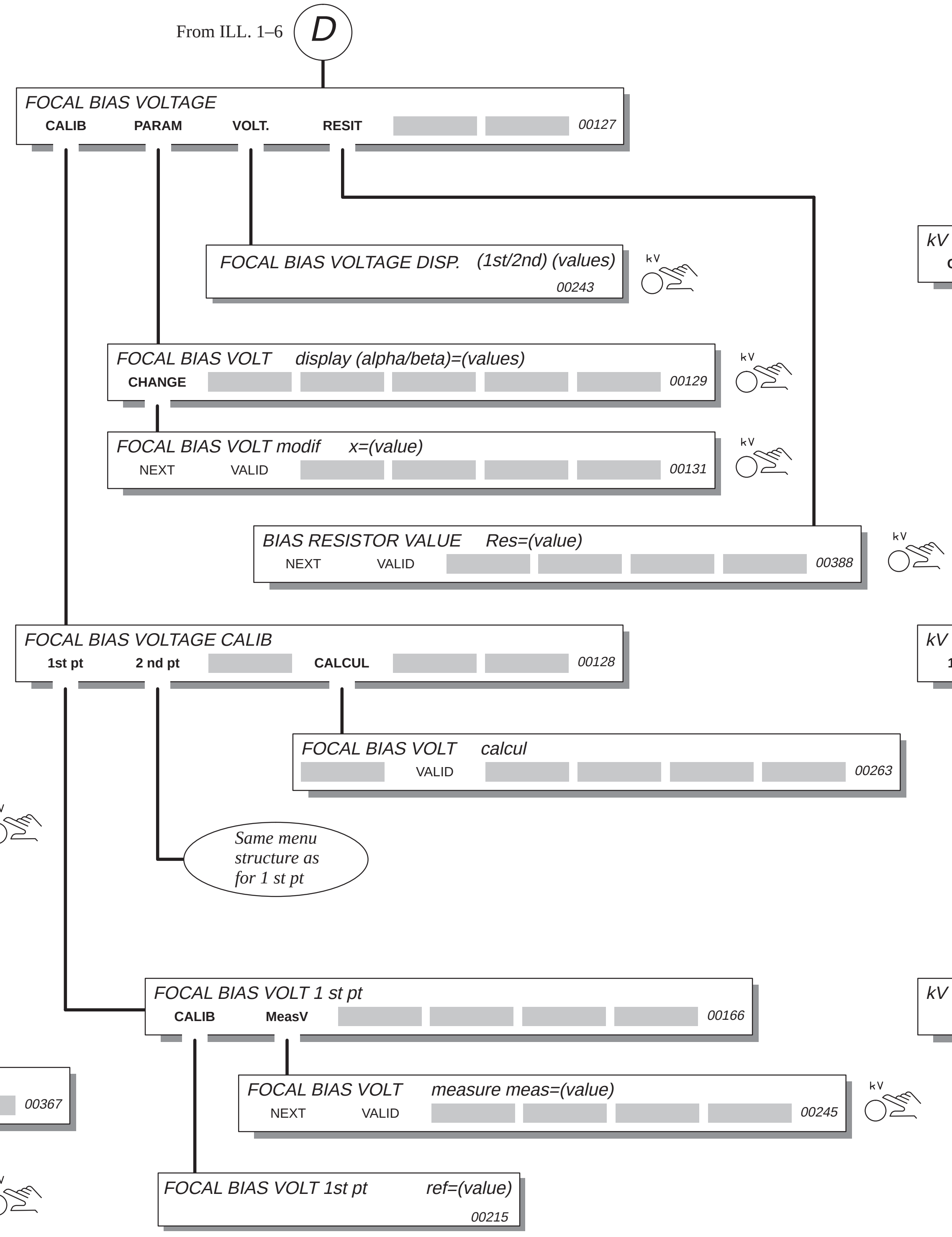

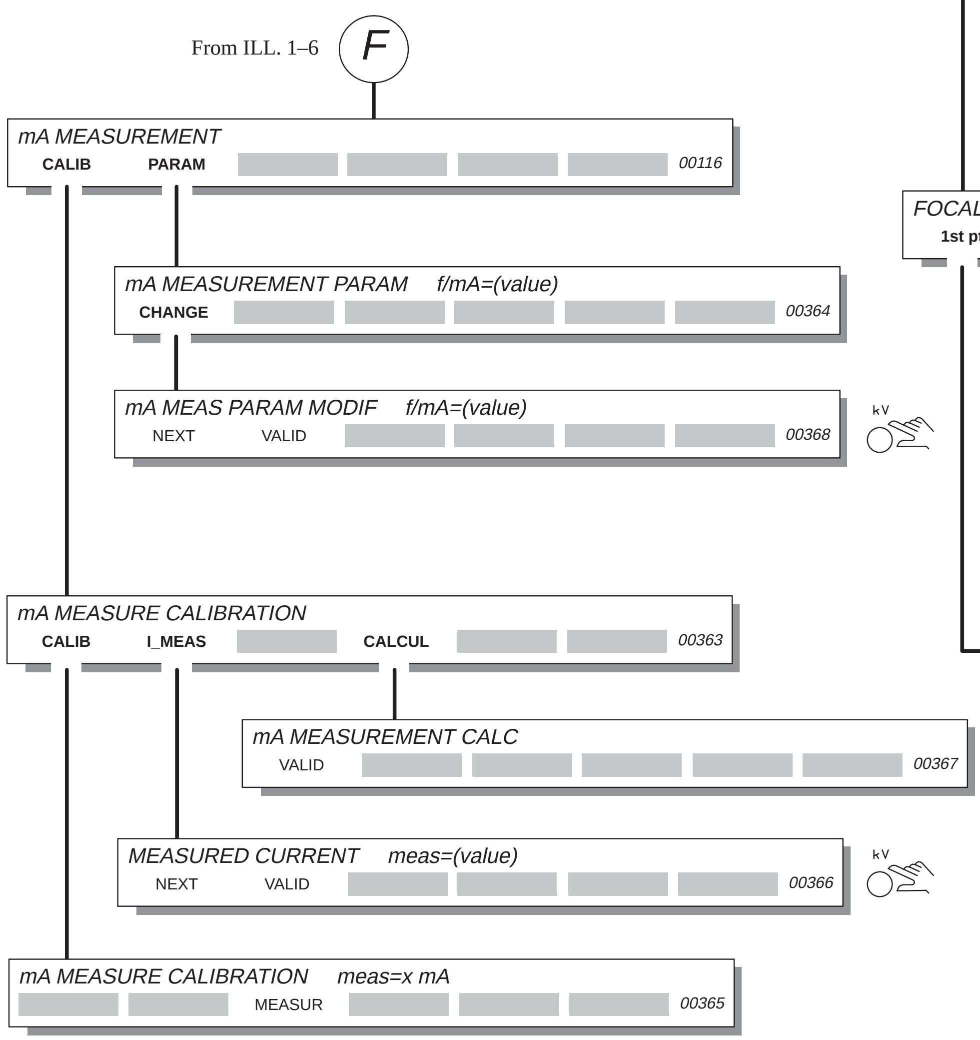

ILLUSTRATION 1–10
INSTALLATION MENU TREE STRUCTURE (cont'd)

KEY

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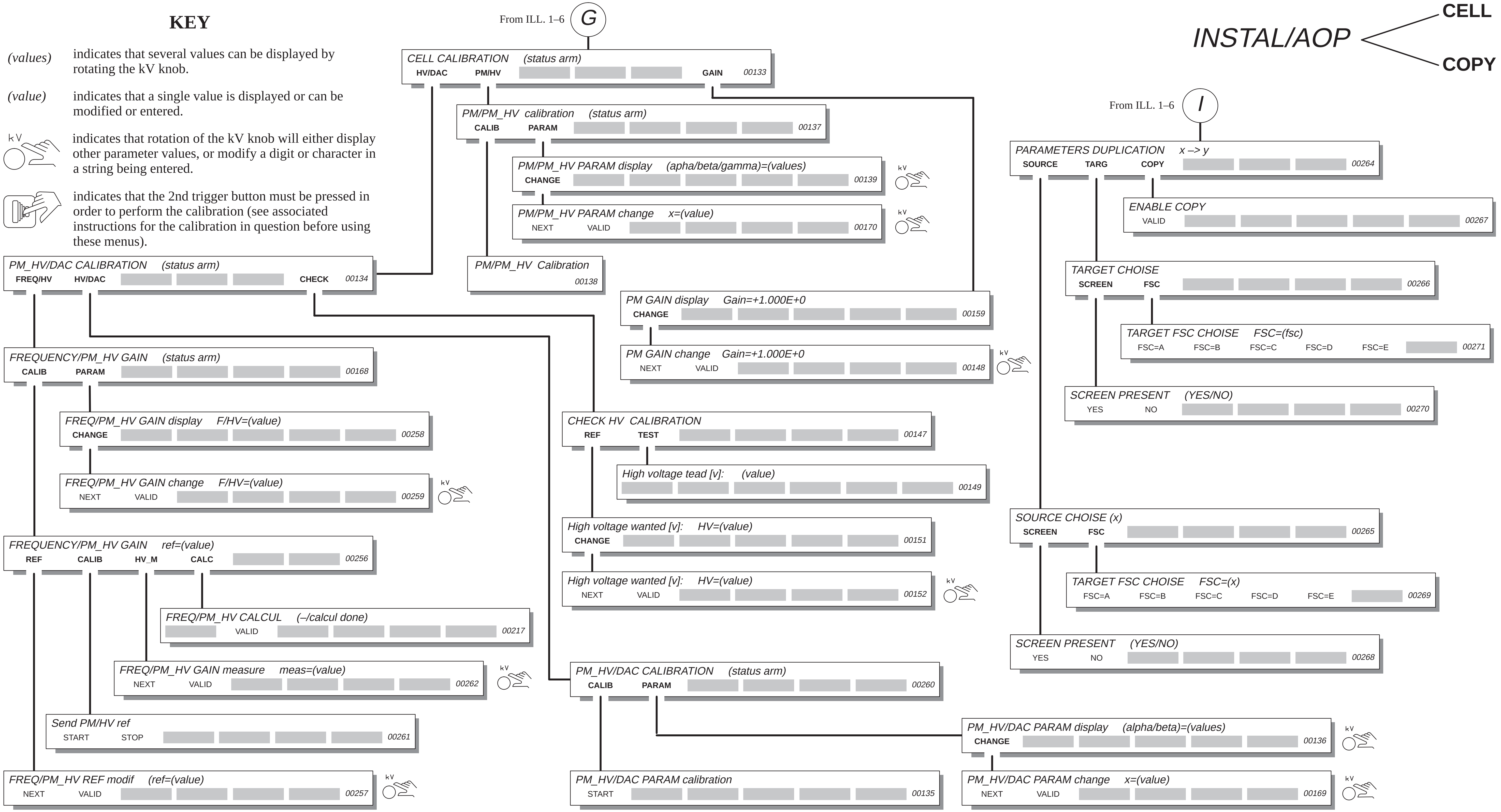

INSTALLATION

ILLUSTRATION 1–11
INSTALLATION MENU TREE STRUCTURE (cont'd)

KEY

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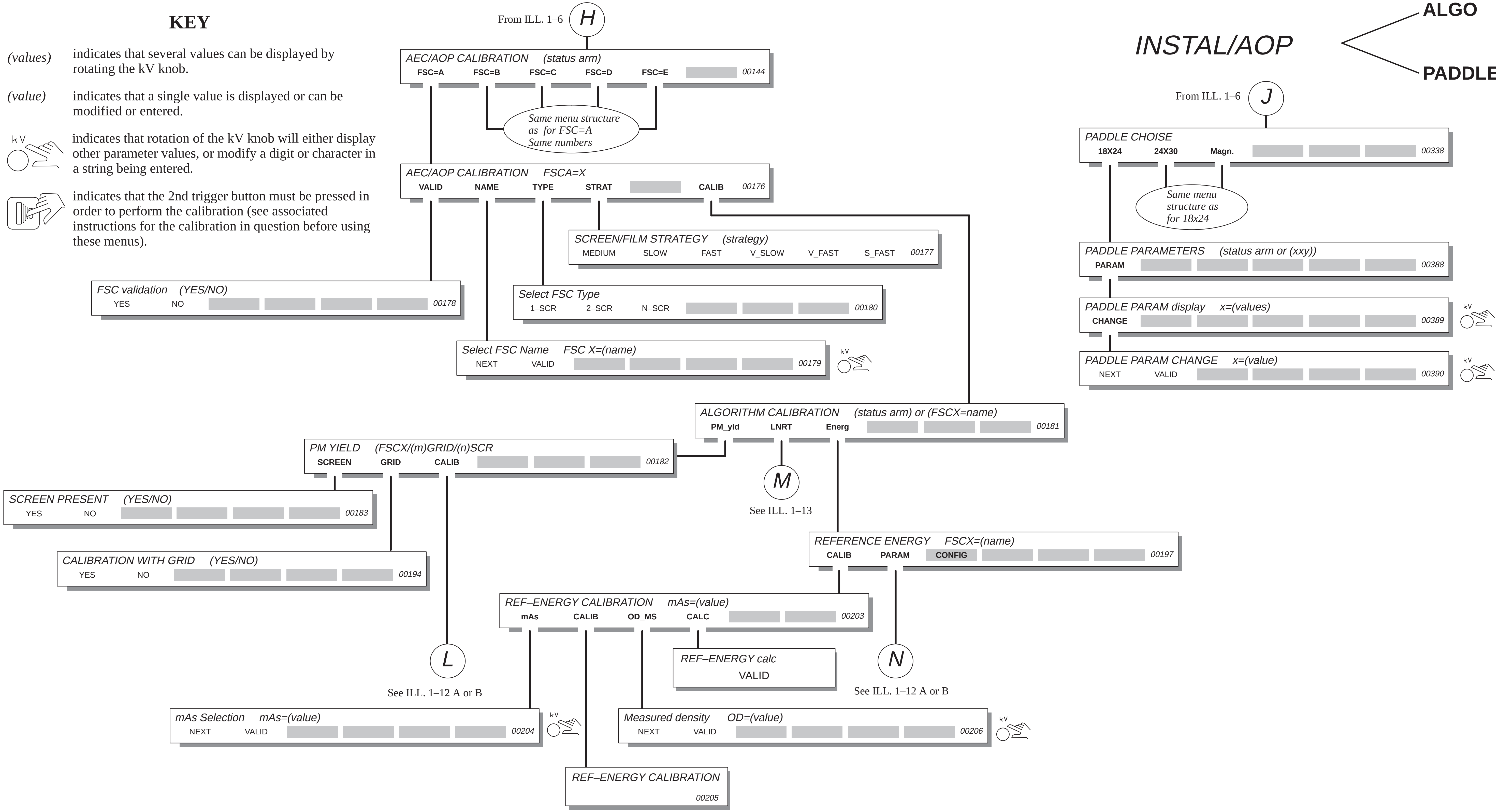

ILLUSTRATION 1–12A
INSTALLATION MENU TREE STRUCTURE WITH SOFTWARE <= V2.21 (cont’d)

KEY

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KEY

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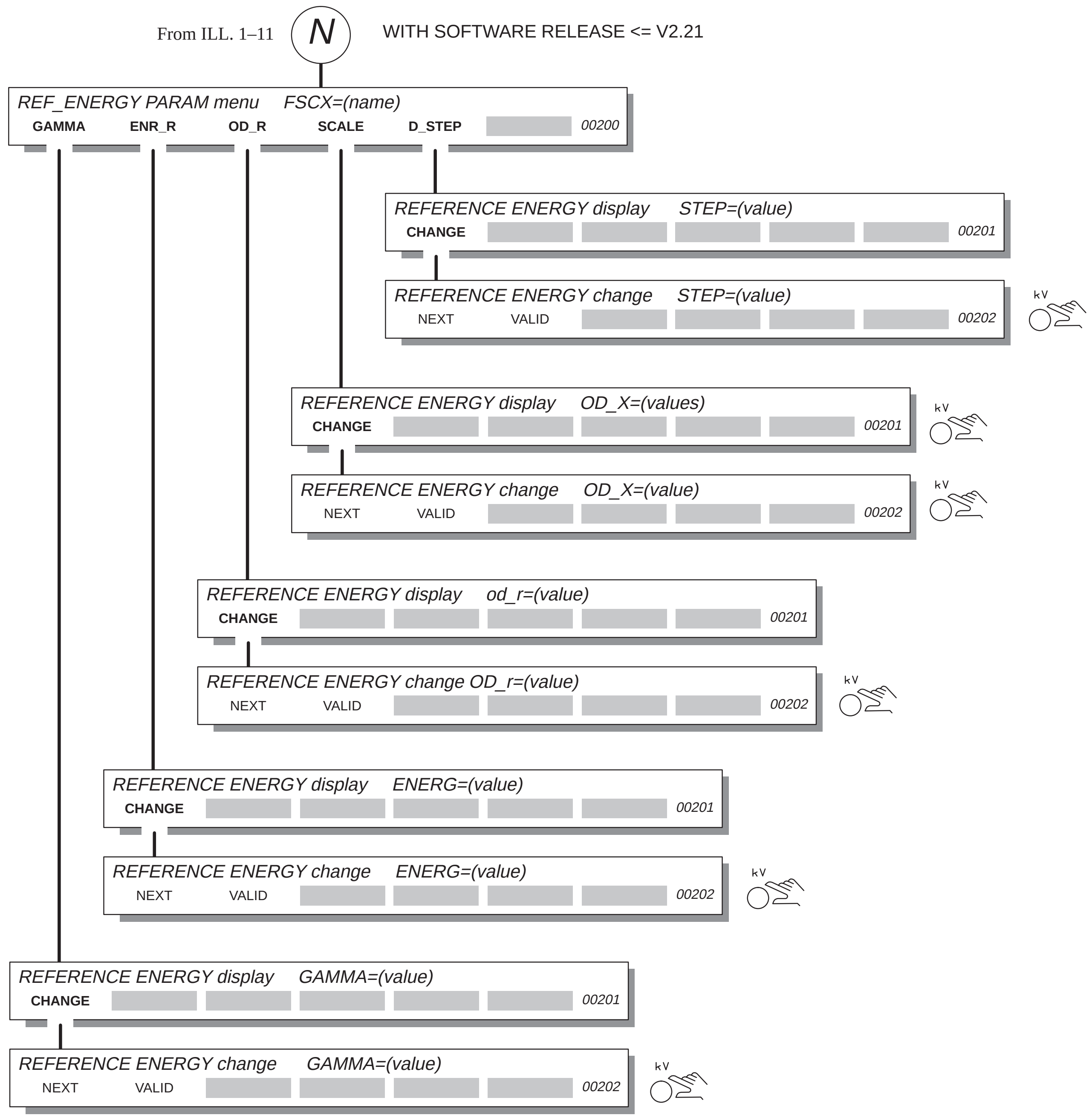

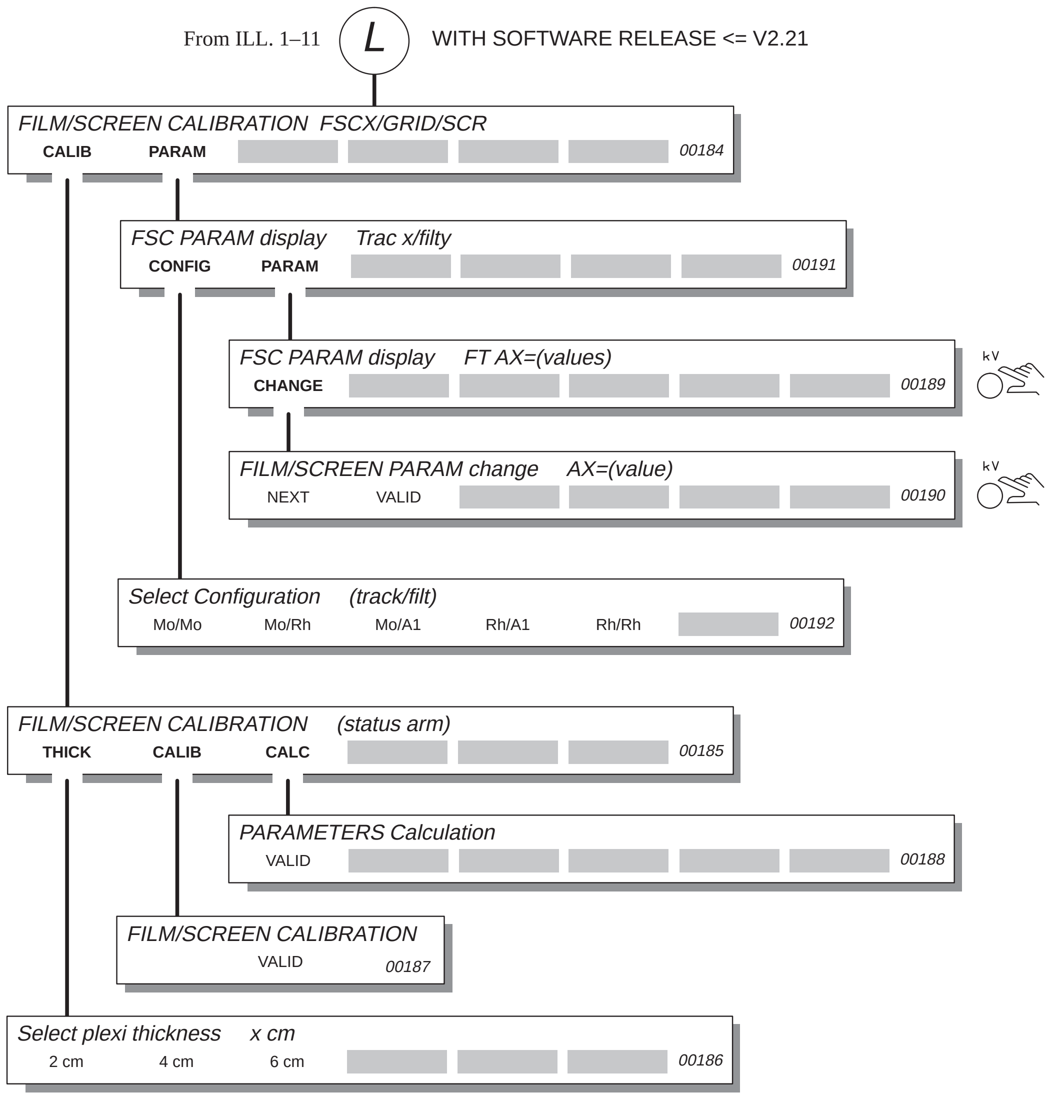

INSTALLATION

ILLUSTRATION 1–12B
INSTALLATION MENU TREE STRUCTURE WITH SOFTWARE >= V2.31 (cont'd)

KEY

(values)	indicates that several values can be displayed by rotating the kV knob.
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KEY

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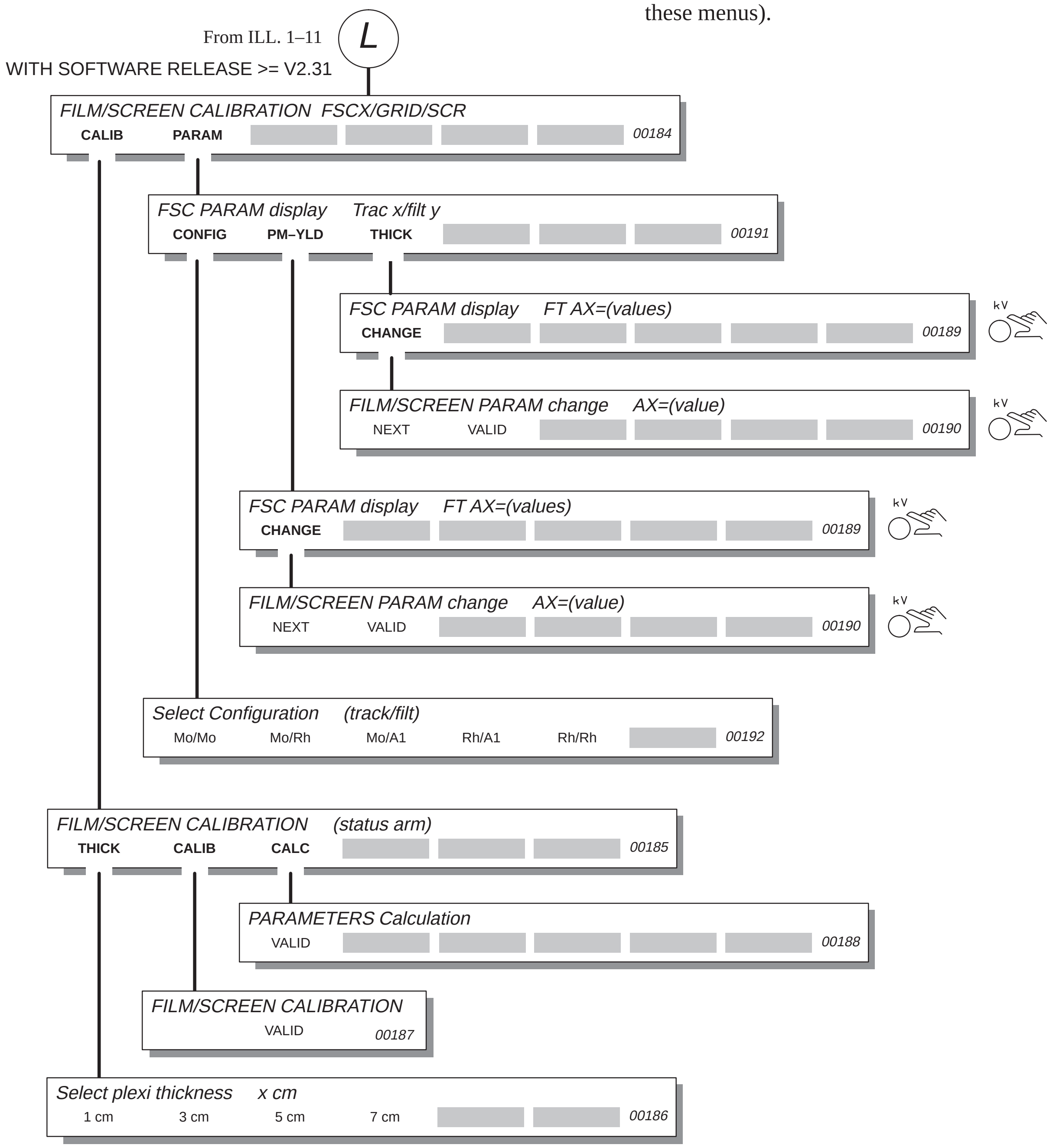
indicates that the 2nd trigger button must be pressed in order to perform the calibration (see associated instructions for the calibration in question before using these menus).



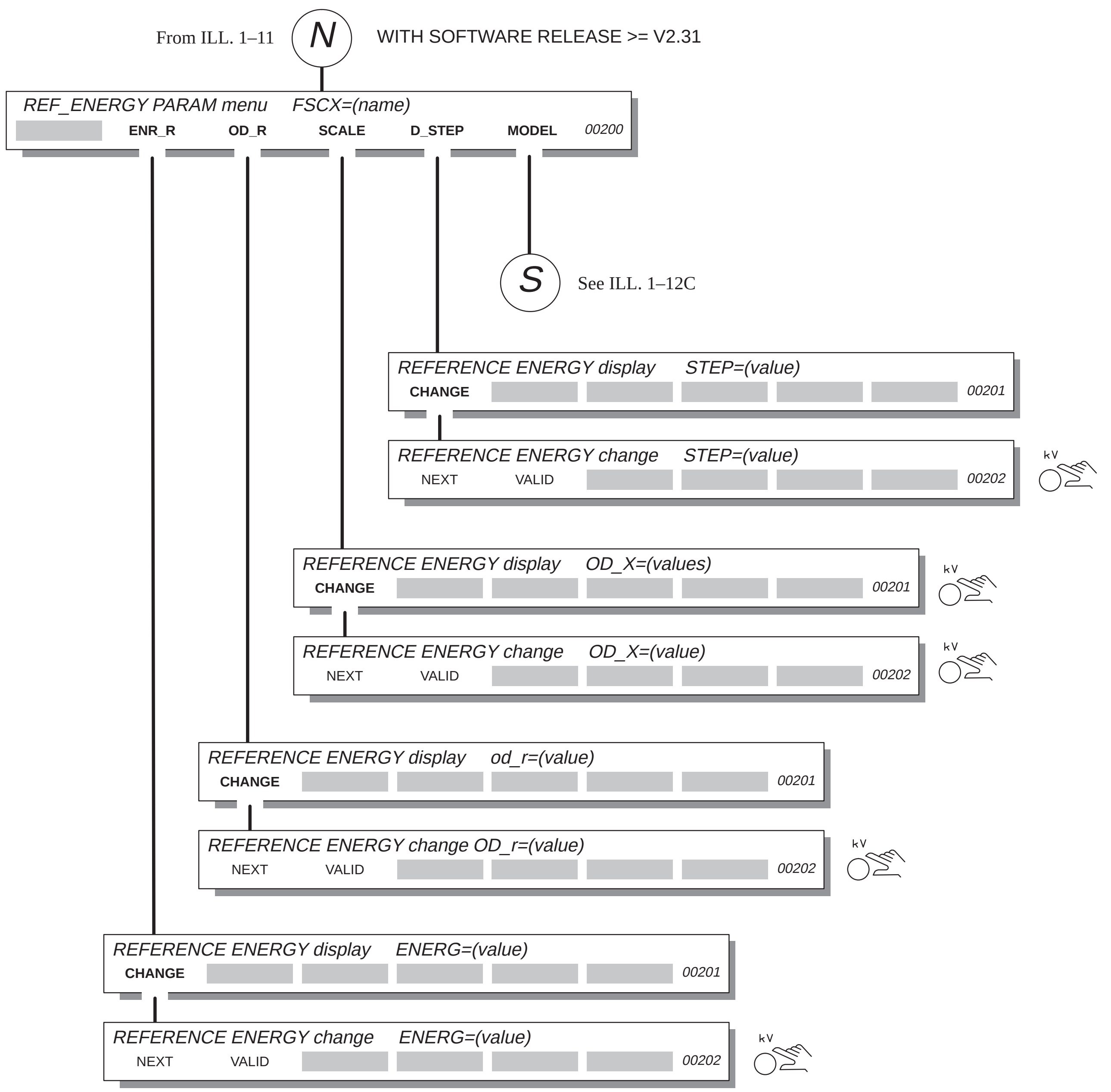


ILLUSTRATION 1–12C
INSTALLATION MENU TREE STRUCTURE WITH SOFTWARE >= V2.31 (cont'd)

KEY

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KEY

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INSTAL/AOP — ALGO — PADDLE

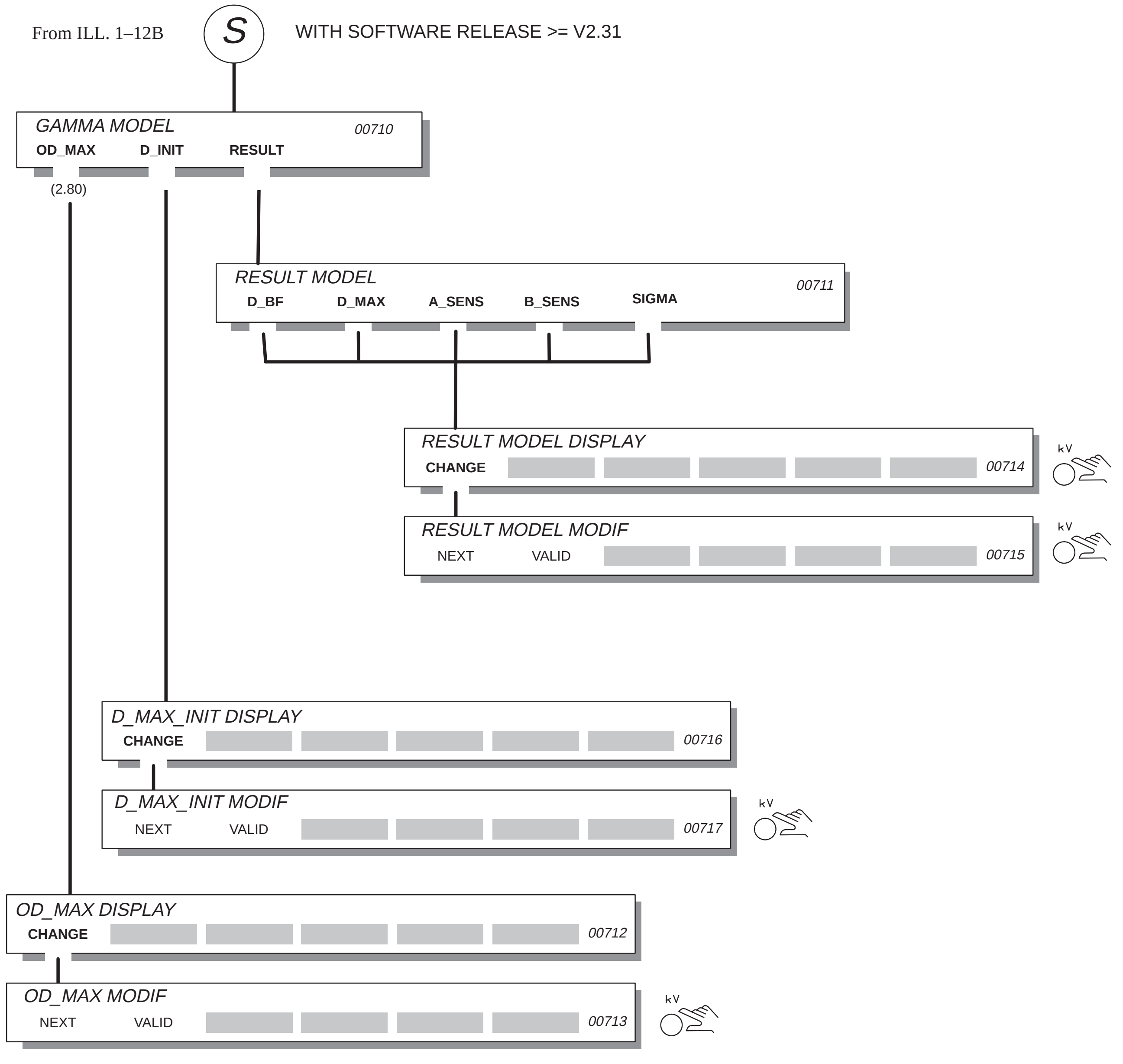


ILLUSTRATION 1–13
INSTALLATION MENU TREE STRUCTURE (cont'd)

KEY

(values) indicates that several values can be displayed by rotating the kV knob.

(value) indicates that a single value is displayed or can be modified or entered.

kV indicates that rotation of the kV knob will either display other parameter values, or modify a digit or character in a string being entered.

indicates that the 2nd trigger button must be pressed in order to perform the calibration (see associated instructions for the calibration in question before using these menus).

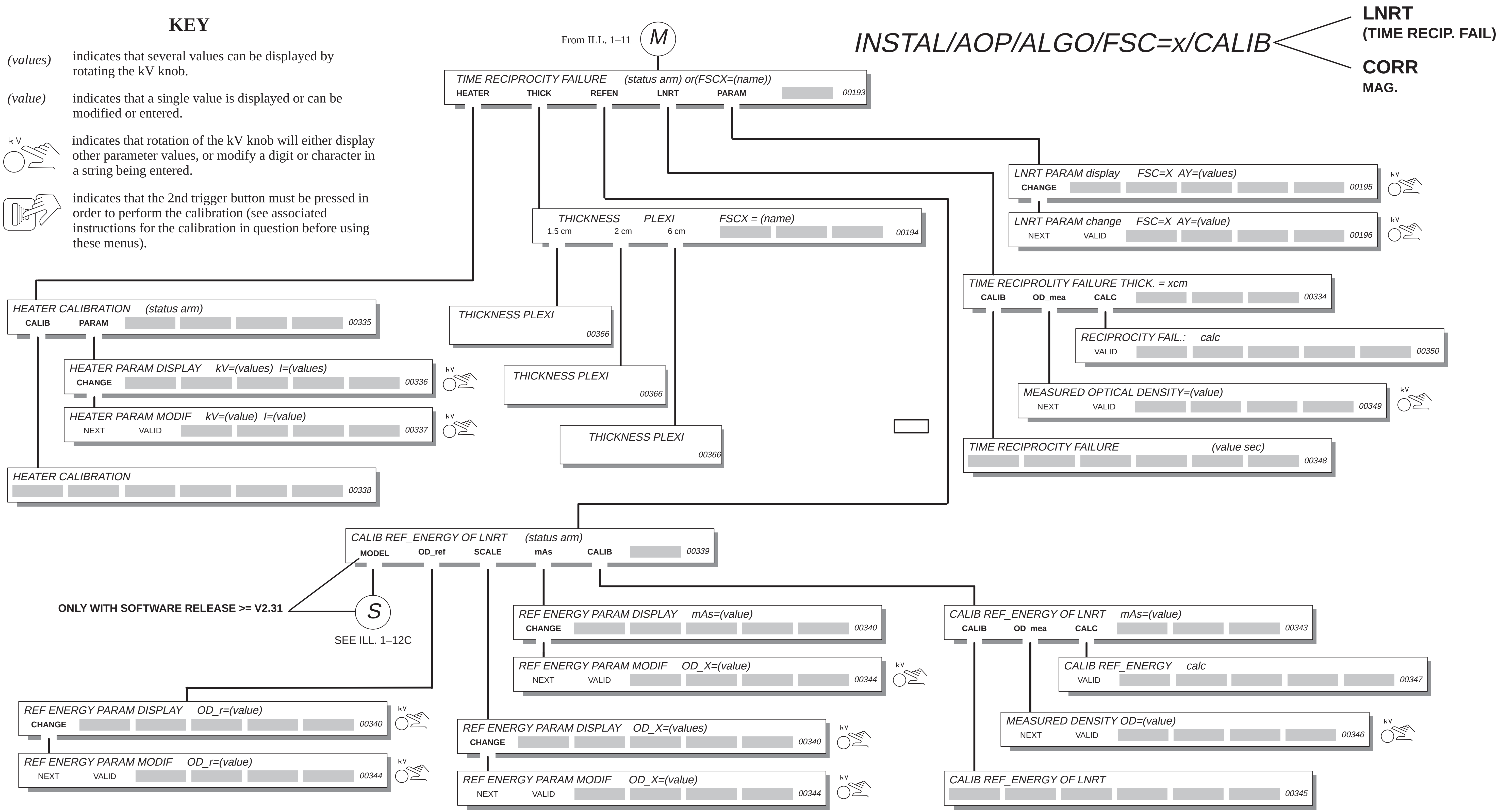


ILLUSTRATION 1–14
INSTALLATION MENU TREE STRUCTURE (cont'd)

KEY

(values) indicates that several values can be displayed by rotating the kV knob.

(value) indicates that a single value is displayed or can be modified or entered.

kV indicates that rotation of the kV knob will either display other parameter values, or modify a digit or character in a string being entered.

indicates that the 2nd trigger button must be pressed in order to perform the calibration (see associated instructions for the calibration in question before using these menus).

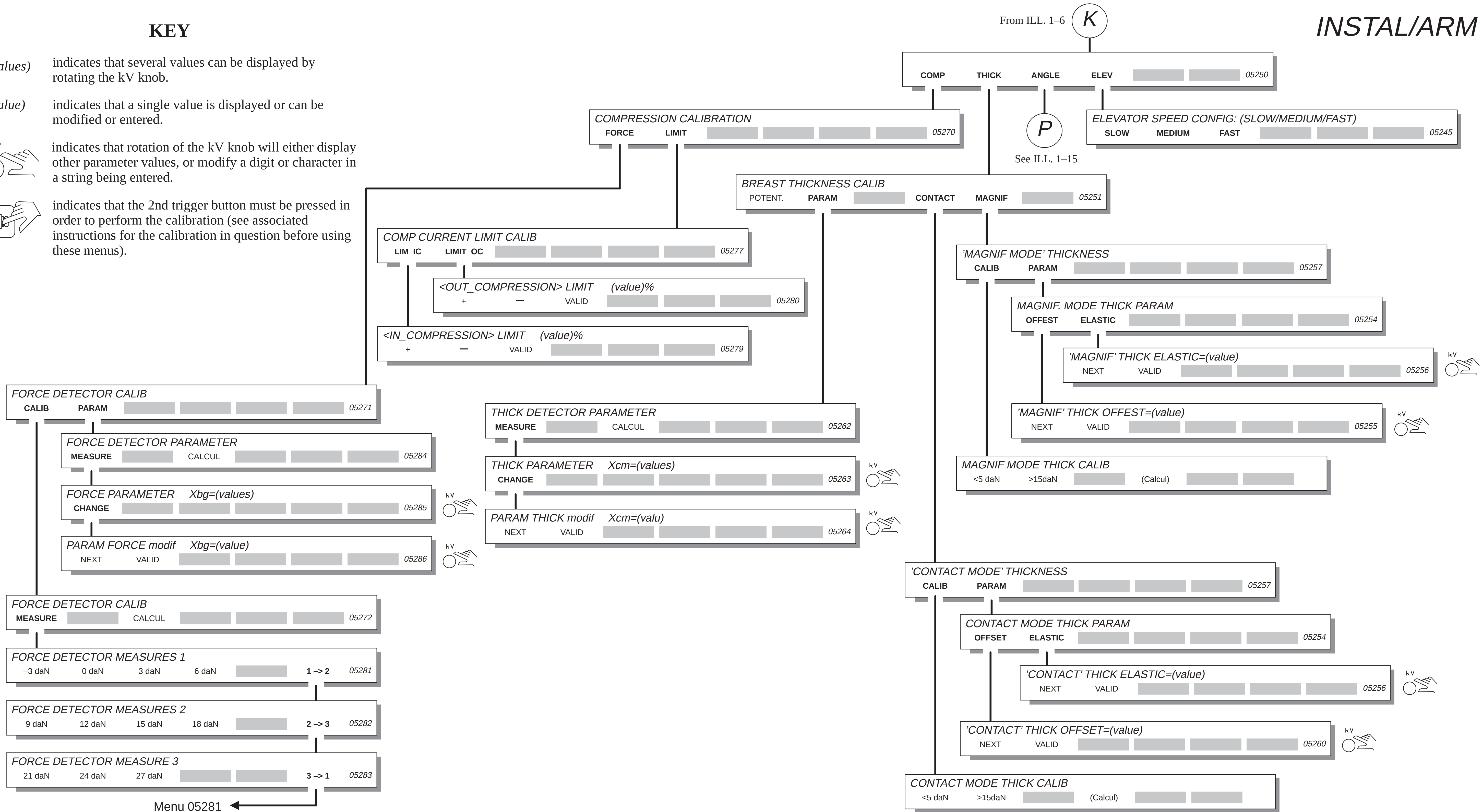


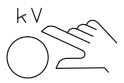
ILLUSTRATION 1–15
INSTALLATION MENU TREE STRUCTURE (cont'd)

INSTAL/ARM/ANGLE

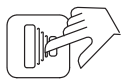
KEY

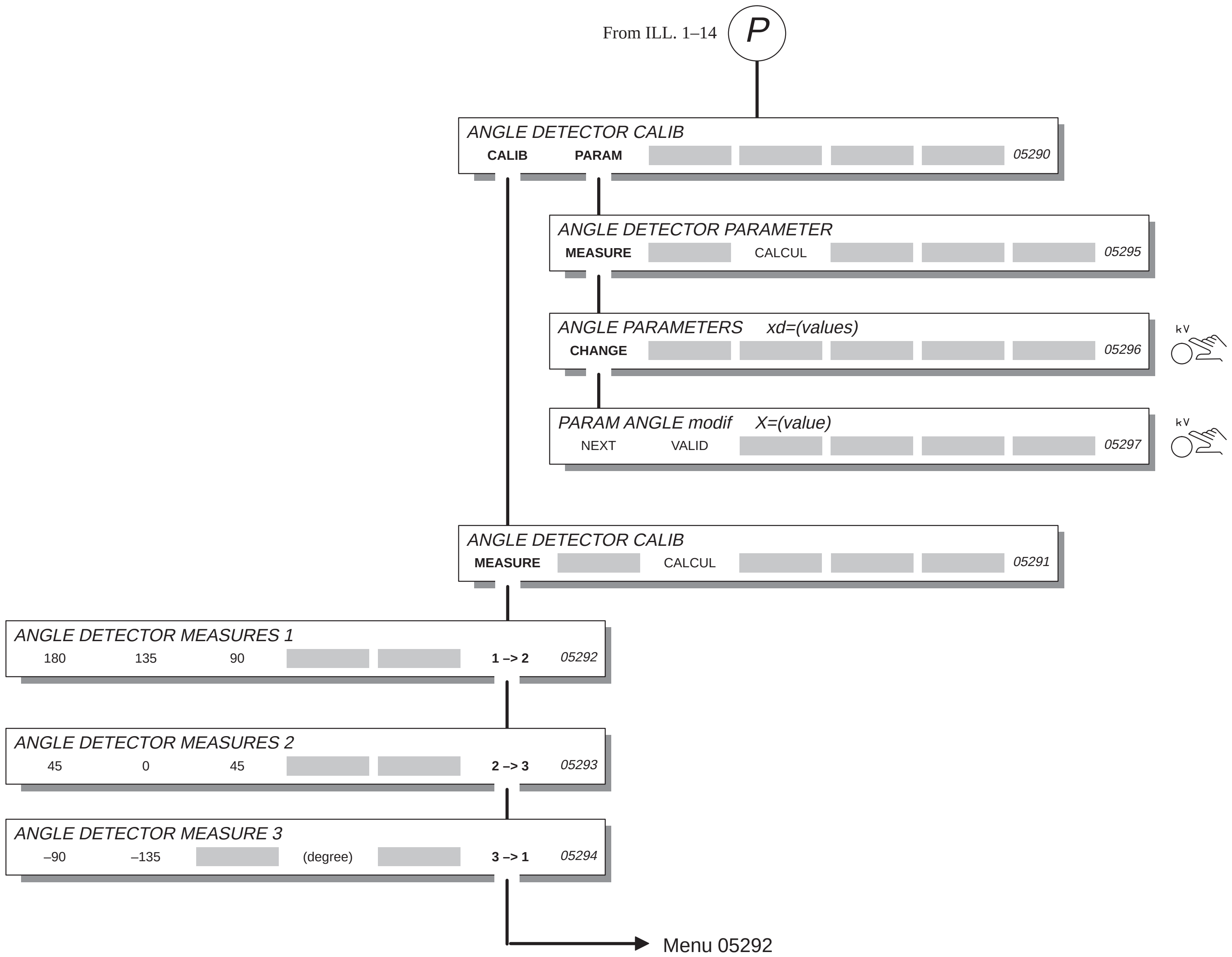
(values) indicates that several values can be displayed by rotating the kV knob.

(value) indicates that a single value is displayed or can be modified or entered.



indicates that rotation of the kV knob will either display other parameter values, or modify a digit or character in a string being entered.


indicates that the 2nd trigger button must be pressed in order to perform the calibration (see associated instructions for the calibration in question before using these menus).



3–6 Accessing the Different Installation Menus in the Tree Structure

Once you have followed the installation mode access procedure given in Section 3–4, you can go down into the various installation menus by selecting them progressively using the six keys below the console display window. See Section 3–5.

To move upward in the tree structure, press the ”SETUP” key  one time for each level desired. This is useful for going from one branch of the tree structure to another during installation procedures, or if you accidentally go into an unwanted branch.

3–7 Saved Parameters and checksum

a. Parameters resulting from installation or non–proprietary maintenance procedures are saved in a memory zone whose contents are not lost when the Senographe is switched off.

b. To perform a saved parameter memory checksum, go to the ”CKSUM” menu and run this function. You can now return to application mode without receiving a ”CHECKSUM ERROR” message.

c. It is not mandatory to do a checksum each time you leave a menu. There is no risk of losing data if you switch off the Senographe displaying ”checksum error”.

   The only purpose of checksum error is to lock the application mode against any random data change. When you perform the checksum you only tell the software that you accept the data you change before (entered normally or calibrated).

INSTALLATION

3–8 Re–loading of Default (Initial) Parameters

WARNING

THE FUNCTIONS DESCRIBED IN THIS SECTION ARE NORMALLY NEVER USED AFTER THE SENOGRAPHE HAS LEFT THE FACTORY.

To re–load the default parameters (prior to any installation or calibration procedures), use the respective ”CLEAR” menu. The use of this menu executes a software ”power–up” comparable to the very first hardware power–up.

When the INSTAL ”CLEAR” menu is used, the Senographe leaves the installation menus and returns to the application mode. In order to re–access the installation mode after performing a INSTAL ”CLEAR”, you must change the position of the installation menu enable switch. See Section 3–4, or use the ”PASSWD” key.

Following use of the ”CLEAR” menu, the software displays a ”CHECKSUM ERROR” message. **All** generator or gantry calibration procedures must be performed, followed by a ”CKSUM” in order to enable use of the new parameters.

WARNING

USE OF THE INSTAL ”CLEAR” MENU RESETS, FROM A SOFTWARE POINT OF VIEW, THE THERMAL CONDITION OF CRITICAL COMPONENTS (TUBE, TUBE HOUSING, GENERATOR, ETC.) TO A ”COLD” CONDITION. THIS MEANS THAT THE SOFTWARE THERMAL PROTECTIONS CAN NO LONGER DETECT AN EXCESSIVE TEMPERATURE IMMEDIATELY FOLLOWING USE OF THIS MENU.

THE INSTAL ”CLEAR” MENU MUST THEREFORE BE USED WITH CARE, ESPECIALLY WHEN OPERATIONS JUST PRIOR TO ITS USE HAVE SIGNIFICANTLY RAISED CRITICAL COMPONENT TEMPERATURES (e.g. NUMEROUS HIGH–POWER AND/OR LENGTHY EXPOSURES).

CAUTION

The existing parameters are PERMANENTLY LOST when a ”CLEAR” menu is executed. A COMPLETE RE–CALIBRATION of the assembly (generator or gantry) must therefore be performed.

3–9 Returning to the Application Mode

To return to the application mode press the ”SETUP” key  n times, where n is the number of levels that you have gone down into the installation tree structure.

Note: If you have performed any calibration procedures or otherwise changed any saved parameter values, you must perform a saved parameter memory checksum before returning to the application mode. See Section 3–7. Otherwise, you will receive a ”CHECKSUM ERROR” message.

Note: If you switch off the Senographe for any reason and then switch it on again, you must once again change the position of the installation menu enable switch before being able to have access to the installation mode. See Section 3–4.

3–10 Configuration Parameters

3–10–1 Gantry Present/Absent (”PRS_A”)

Menu accesspath: **SETUP/INSTAL/CONFIG/PRS_A**

The installation software provides access to a parameter called ”PRS_A ”(PReSence_Arm), whose value can be set to either ”YES” or ”NO”. The value of ”PRS_A” indicates, to the software, the presence or absence of the gantry,.

The value of ”PRS_A” to ”NO” is used by Manufacturing only.

Following a ”CLEAR” (see section 3–8),”PRS_A” takes on the value ”NO”.

”PRS_A” is kept in the saved parameter memory, which means that its value is retained when power is turned off.

The value of ”PRS_A” can be set by following the menu access path shown above. Select ”YES” or ”NO” and perform a ”CKSUM”.

3–10–2 Type Selection (”700T” or ”800T”)

Menu access path: **SETUP/INSTAL/CONFIG/TYPE**

The installation software provides access to a parameter called ”TYPE” (Type of Senographe), whose value can be set to either ”700T” or ”800T”. The value of ”TYPE” indicates to the software, the selection of Senographe configuration 700T or 800T.

Following a ”CLEAR” (See Section 3–8), ”TYPE” takes on the value ”700T”.

The value of ”TYPE” can be set by following the menu access path shown above. Select ”700T” or ”800T” and perform a ”CKSUM”.

3–10–3 Display of Parameters Following an Exposure

Menu access path: **SETUP/INSTAL/CONFIG/DISP**

To simplify the service engineer's work, the software can display certain parameters following an exposure. These parameters are displayed on the console display window in two groups which appear alternately:

kv	mAs	mA	Time	I heater

and

offset	photo cell HV	photo cell measurement result	corrected photo cell measurement result	thickness

Where:

offset = offset of photo cell measurement (dark current + electrical offset)
photo cell measurement result = photo cell/mA measurement
corrected photo cell measurement result = photo cell measurement result corrected according to Senographe configuration
thickness = breast compressed thickness in cm of equivalent plexiglass

This ”DISP” parameter is turned on and off by following the menu access path shown above. Select ”YES” or ”NO”. A ”CKSUM” is NOT necessary because this parameter is not a saved parameter. When power is turned off, the value of ”DISP” is lost and reverts to ”NO” at the next power–up.

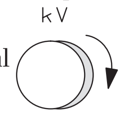
3–10–4 Calendar and Clock

Menu acces path: **SETUP/INSTAL/CONFIG/DATE**

The CPU is equipped with a calendar and clock that are used for the following functions:

- Thermal protection cooling algorithms, whether or not the generator is turned on.
- Memorization of the date and time of an equipment failure.
- Last date of access to the installation mode.

The last function makes it possible for the service engineer to verify the date and time of his last visit. He can also determine if access to the installation modes was made by unauthorized persons since his last visit.

The date is modified by following the menu access path shown above and then selecting ”DATE”. Select ”NEXT”, then rotate the kv dial 

to obtain the desired day. Select ”NEXT” again and rotate the kv dial to obtain the desired month. Repeat once more to obtain the desired year, then select ”VALID” to confirm the date.

Note: The date is entered in the order DAY/MONTH/YEAR. For example, if the date to be entered is October 9, 1991, enter 09, then 10, then 91.

The time is modified by following the menu access path shown above and then selecting ”HOUR”. Enter the time of day as explained above for the date, using the ”NEXT”, kv dial and ”VALID” functions.

Note: The time of day is entered in 24–hour format. For example, if the time of day is 3:13:27 PM, you must enter 15:13:27.

Note: Following a generator ”CLEAR” of saved parameters, the calendar and clock, as well as the last installation mode access date are initialized to the release date of the generator software version at 0:00:00.

3–10–5 Visual Representation of Numerical Parameters

When displayed on the console, most numerical values appear in the form of real numbers in scientific notation floating point format with four significant figures.

Some examples follow:

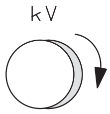
–1.250E+3 = –1250.00

+4.345E–1 = 0.4345

+1.000E+0 = 1.000

3–10–6 Visual Display of Parameter Values

A parameter value can be displayed on the Senographe console by accessing the calibration menus for the procedures that compute the parameter in question. Typically this is done when you are at a menu choice between ”CALIB” and ”PARAM”. Select ”PARAM” to display the parameter value.

Note: If the calibration procedure computes more than one parameter, turning the kv dial 

will display them one at a time in sequence.

As an example, let’s look at the values of scale factor K and offset voltage VOF of tube track 1 which are computed by the heater current scale factor calibration routine: follow the menu access path **SETUP/INSTAL/GENE/HTR_SCL/TRACK1/PARAM**.

On the right of the first console display line appears the value of scale factor K. Rotate the kv dial clockwise by one position. Now offset voltage VOF appears instead.

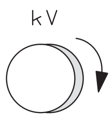
CAUTION

DO NOT attempt to modify these calibrated parameter values.

3–10–7 Modification of a Parameter Value or Entry of a Measurement

Parameters are entered or modified in scientific notation form.

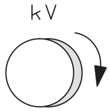
When at the parameter value modification or measurement entry level in the menu structure, there are two possible selections: ”NEXT” and ”VALID”. Begin by selecting ”NEXT”. This enables modification of the first character to be entered. Successive selections of ”NEXT” will enable modification of each character to be entered.

Use the kv dial 

to modify the character being entered. Select ”VALID” when all characters are correctly entered.

CAUTION

NEVER modify a parameter value on a Senographe that has already been calibrated unless you have a specific reason. Otherwise, doing so, in general, would necessitate entering the default parameter value(s) and completely re–calibrating the sub–assembly (generator or gantry) for the parameter value(s) in question.

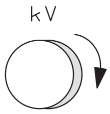
As an example, let’s set the maximum exposure time to 5.7 (+5.700E+0) seconds. Follow the menu access path **SETUP/INSTAL/CONFIG/CONFIG/T_MAX**. Select ”NEXT”. Turn the kv dial 

to set the sign of the value to be entered (in this example, the value is positive +). Select ”NEXT” again. Turn the kv dial to set the value of the first digit to 5. Continue selecting ”NEXT” and turning the kv dial until you have input +5.700E+0 (mantissa sign and four digits plus exponent sign and one digit). If you make a mistake, select ”NEXT” repeatedly until you arrive at the faulty value, then correct it by rotating the kV dial. If you truly wish to enter the parameter value, select ”VALID”, keeping the above CAUTION in mind before doing so! To exit the modification routine, press ”SETUP” once.

Note: Pressing the ”VALID” key is effective ONLY when the entire value, including exponent, is displayed. This means that if you correct a digit after making a mistake, as described above, you must press the ”NEXT” key repeatedly until the entire parameter value is visible before being able to enter the new value using the ”VALID” key.

3–10–8 Entry of an Alpha–Numeric Value

This is the case when entering screen pair names (seven characters maximum allowed).

The principle is identical to that used for parameter value entry as described in Section 3–10–7 (repeated use of ”NEXT”, kv dial 

and ”VALID”).

Here, rotation of the kv dial gives access to the following characters:

- The 26 letters of the alphabet
- The ten digits from 0 to 9
- The colon ”:”

The choice of a screen pair name is confirmed by pressing ”VALID”.

3–11 Principles of Generator Calibration

3–11–1 Vocabulary

The following key words are found throughout the generator installation menus:

”CALIB” designates a menu that steers you to the calibration procedure itself.

”PARAM” designates a menu that steers you to other menus that allow you to display and modify parameters.

”CHANGE” designates a menu that allows you to modify a parameter.

”REF” designates a menu within a calibration procedure that allows you to modify the command input (mAs for reference energy, photo cell HV for the frequency/HV calibration, heater current for the heater current scale factor calibration, etc...).

”CALCUL” designates a menu that steers you to the execution of the computations necessary to obtain the parameter values.

3–11–2 Use of the First Trigger/Second Trigger Buttons During Installation

In general, calibration computations are started by pressing the ”SECOND TRIGGER” button. (The ”FIRST TRIGGER” button is not used during installation.)

After going down through the different menus, the final ”CALIB” selection steers you to a menu that has no second line displayed on the console display window (i.e. there are no more menus to select). It is at this level that the calibration computation is started by pressing the ”SECOND TRIGGER” button.

3–11–3 Inhibit Conditions Due to Gantry Absence

The AOP calibration procedures (”CELL” and ”ALGO”) need to exchange information with the CPU.

Therefore, before performing these calibration procedures, it is necessary to set the value of ”PRS_A” to ”YES”. See Section 3–10–1. Otherwise, error messages indicating software absence of the gantry will appear on the console display, and access to the ”CALIB” menus is inhibited (only display and modification of parameters will be possible).

3–11–4 Inhibit Conditions Due to Grid Absence/Presence

Many of the AEC calibration procedures are performed ”with grid” and ”without grid”. For such procedures, the software indicates whether or not the grid is present. The calibration software will verify agreement between physical presence/absence of the grid and the service engineer’s choice of calibration ”with grid” ”or without grid”. If there is disagreement, error messages will appear and access to the ”CALIB” menu will be inhibited.

3–11–5 Displayed Messages During Exposure–Producing Calibration Procedures

The following messages are displayed in the upper right–hand corner of the console display during calibration procedures that make X–ray exposures:

- Exposure number (when exposure is valid)
- Arcing
- Failure (return to application mode for explicit message)
- Excessive temperature
- End of series of exposures

Certain calibration procedures that make X–ray exposures insert, in alternation with the above messages, specific messages such as:

- ”Too much plexi”
- ”Not enough plexi”
- ”Reduce HV, same point”
- Etc...

3–11–6 Other Displayed Messages

In general, the software displays, as much as possible, messages indicating the phases of calibration such as:

- ”Calibration end”
- ”Calcul done”
- Etc...

SECTION 4
SITE PREPARATION

See Pre–Installation Manual for information on site preparation.

INSTALLATION

SECTION 5
INSTALLATION STEERING

CAUTION

The installation of the Senographe must be performed according to the CONTENT as well as the CHRONOLOGICAL ORDER given in this section. Failure to do so can result in faulty calibration of the product and subsequent loss of performance.

Note: Use the installation steering guide (see illustration 1–16) and the Flow Chart (see illustration AUCUN LIEN) as a memo to assist you during the Installation

Use IST 011 ”INSTALLATION FORM” to record all values obtained.

1. Unpack Senographe and accessories.

   See Job Card IST 001 ”UNPACKING THE EQUIPMENT AND CHECKING.
2. Physically place, console, protective glass screen, pedals, etc.

   See Job Card IST 002 ”PHYSICAL INSTALLATION AND PROTECTIVE GLASS FITTING”.
3. Attach appropriate safety labelling to the equipment according to local regulations.

   See Job Card IST 008 ”SAFETY LABELLING”.

CAUTION

The attachment of appropriate safety labelling to the equipment is a LEGAL REQUIREMENT for operation of an X–ray producing unit.

4. Remove both covers cabinet and connect the console.

   See Job Card IST 003 ”REMOVAL OF CABINET COVERS AND CONSOLE CONNECTION”.
5. Inspect inside of cabinet for loose or disconnected cables, wires, connectors, etc. Refer to MIS maps if necessary (see Schematics book).
6. Connect mains supply to cabinet and configure generator for mains voltage,.

   See Job Card IST 004 ”CONNECTION OF MAINS SUPPLY”.
7. Connect room lamps wiring and room door switch (optional).

   See Job Card IST 005 ”CONNECTING ROOM LAMPS AND ROOM DOOR”.
8. Check basic supply voltages.

   See Job Card IST 006 ”CHECKING BASIC POWER SUPPLY VOLTAGES”.

WARNING

DO NOT ACCESS THE INSTALLATION SETUP MENUS DURING THIS CHECK. FOLLOW THE PROCEDURE IN THE ORDER GIVEN. DO NOT PERFORM ANY CHECKSUM OPERATIONS. EXTREMELY IMPORTANT INFORMATION ABOUT THE INTEGRITY OF THE SENOGRAPHE RAM CONTENTS CAN BE PERMANENTLY LOST IF THESE INSTRUCTIONS ARE NOT FOLLOWED CORRECTLY.

INSTALLATION

9. Check jumpers and switches.
   See Job Card IST 007 ”JUMPERS AND SWITCHES”.
10. Measure free space between floor and ceiling of the room.
    If the available height is less than 2.5 meters (about 8.2 feet), perform
    Job Card CAL 011 ”SETTING OF ELEVATOR UPPER TRAVEL LIMIT”.
11. Perform the initial power–up check.

WARNING

VERY IMPORTANT — READ CAREFULLY:

DO NOT ACCESS THE INSTALLATION SETUP MENUS UNTIL THE INSTRUCTIONS INDICATE TO DO SO. FOLLOW THE PROCEDURE IN THE ORDER GIVEN. DO NOT PERFORM ANY CHECKSUM OPERATIONS. EXTREMELY IMPORTANT INFORMATION ABOUT THE INTEGRITY OF THE SENOGRAPHE RAM CONTENTS CAN BE PERMANENTLY LOST IF THESE INSTRUCTIONS ARE NOT FOLLOWED CORRECTLY.

a. Turn on the Senographe and wait for the autotests to execute.
b. Normally, the Senographe will now be in application mode, in the exposure mode and configuration that it was in when last turned off before leaving the factory.

WARNING

THERE SHOULD NOT BE, UNDER ANY CIRCUMSTANCES, A CHECKSUM ERROR MESSAGE ON THE CONSOLE (e.g. ”Checksum error).

IF THIS MESSAGE APPEARS, COMPLETE THIS INITIAL POWER–UP CHECK AND PERFORM THE SOFTWARE CONFIGURATION IN STEP 12. BELOW. THEN PROCEED TO A COMPLETE RE–CALIBRATION OF THE SENOGRAPHE AS GIVEN IN CHAPTER 3. ONCE THIS RE–CALIBRATION IS COMPLETED, CONTINUE WITH STEP 14. BELOW.

12. Perform software configuration.
    See Job Card IST 010 ”SOFTWARE CONFIGURATION”
13. Perform Checking the mains supply for a full power use
    See Job Card CAL 015 “CHECKING THE MAINS SUPPLY FOR A FULL POWER USE”.

WARNING

IF, DURING THE INITIAL POWER–UP CHECK IN STEP 11. ABOVE, THERE WERE ANY PROBLEMS WITH CHECKSUM ERRORS, OR WITH SYSTEM LAST INSTALLATION DATE AND TIME, OR WITH CURRENT TIME AND DATE, IT IS AT THIS POINT, PRIOR TO PROCEEDING TO STEP 14. BELOW, THAT A RE–CALIBRATION WOULD HAVE TO BE PERFORMED. FOR THESE PROCEDURES, SEE CHAPTER 3.

14. Perform preliminary generator and gantry testing.
    See Job Card IST 009 ”SENOGRAPHE PRELIMINARY TESTING”.

15. Check safe–lighting and film processing.
    See Job Card CAL 012 ”CHECKING SAFE–LIGHTING AND FILM PROCESSING”.

Note 1 : For following steps :
use AEC flow chart to assist in following steering guide. See illustration 1–17.

Note 2 : In case of error messages during the following steps, see CAL 023 for explanation of these messages.

16. Calibrate AEC for each screen pair (repeat steps a. to AUCUN LIEN below for each screen pair).

    a. Choose and configure a screen pair.

       Perform the procedures in:
       Job Card CAL 006 ”SCREEN PAIR SELECTION AND CONFIGURATION”.

    b. Calibrate photo cell gain.

       Perform the calibration in:
       Job Card CAL 007 ”PHOTOMULTIPLIER CELL GAIN FOR SCREEN PAIR”.

    c. Determine if reciprocity law failure compensation parameters (LNRT) can be entered manually. If not, perform the necessary calibration to determine them.

       IF the screen and film of the screen pair being calibrated appear in tables 1–1 or 1–2 below, or IF, in your own experience installing the Senographe, you have ALREADY determined parameters A0, A1 and A2 for the SAME screen pair, go directly to step d.

       IF this is not the case, go directly to:
       Job Card CAL 013 ”CALIBRATION OF FILM RECIPROCITY LAW FAILURE COMPENSATION FOR A GIVEN SCREEN PAIR”.

       Once this calibration is finished, write down the newly–determined parameters A0, A1 and A2 for the screen pair being calibrated in table 1–1 below, then SKIP step d. and go DIRECTLY to step AUCUN LIEN .

INSTALLATION

TABLE 1–1
A0, A1 AND A2 VALUES FOR VARIOUS SCREEN PAIRS WITH SOFTWARE < = V2.21

SCREEN BRAND AND TYPE	FILM BRAND AND TYPE	PROCESSOR CYCLE TIME (SEC)	A0	A1	A2
KODAK MIN–R	KODAK MIN–R MA	90	+ 8.854E–2	+ 3.753E–1	+ 2.361E–3
” ” ”	KODAK MIN–R E	90	+ 9.152E–2	+ 2.261E–1	+ 2.964E–3
” ” ”	KODAK MIN–R H	90	+ 1.481E–1	+ 7.495E–1	+ 1.095E–1
” ” ”	KODAK MIN–R M	90	+ 1.145E–1	+ 2.734E–1	+ 4.605E–2
” ” ”	3M TRIMAX HM	90	+ 1.000E+0	+ 8.479E–2	+ 1.210E–2
KODAK MIN R2190 MIN R2000	KODAK MIN–R 2000	90	+1.629E–1	+ 2.061E–1	+ 1.622E–1
AGFA MR detail S	AGFA MR5–II	90	+ 1.557E–1	+ 5.837E–1	+ 1.738E–1
” ” ”	AGFA MR3–II	90	+ 9.599E–2	+ 1.777E–1	+ 8.994E–2
” ” ”	AGFA MR6–III	90	+ 1.571E–1	+ 3.125E–1	+ 1.937E–1
3M T2–M	3M FM	90	+ 1.570E–1	+ 4.357E–1	+ 1.440E–1
” ” ”	3M HM	90	+ 1.438E–1	+ 2.574E–1	+ 8.461E–2
” ” ”	3M HCM	90	+ 1.074E–1	+ 5.694E–1	+ 5.576E–2
DUPONT Fast detail	DUPONT MICROVISION	90	+ 1.474E–1	+ 3.636E–1	+ 1.422E–1
KODAK MIN–R	DUPONT MICROVISION	90	+ 1.041E–1	+ 1.347E–1	+ 6.556E–2
KONIKA M100	KONIKA CM	90	+ 1.128E–1	+ 5.453E–1	+ 3.298E–1
FUJI FINE	FUJI UM–MH	90	+ 9.297E–2	+ 6.245E–1	+ 1.944E–3
” ” ”	FUJI UM–MA	90	+ 7.061E–2	+ 4.715E–1	+ 1.702E–3

TABLE 1–2
A0, A1 AND A2 VALUES FOR VARIOUS SCREEN PAIRS WITH SOFTWARE > = V2.31

SCREEN BRAND AND TYPE	FILM BRAND AND TYPE	PROCESSOR CYCLE TIME (SEC)	A0	A1	A2
KODAK MIN R2190 MIN R2000	KODAK MIN–R 2000	90	+1.867E–1	+ 4.628E–1	+ 1.821E–1

d. Calibrate reference energy.

Enter manually the three reciprocity law failure compensation parameters (A0, A1 and A2) either from table 1–1 or from your own notes from a previous installation of the same screen pair on another Senographe for the screen and film of the screen pair being calibrated:

Starting from application mode, select
SETUP/INSTAL/AOP/ALGO/FSC=*x*/CALIB/LNRT/PARAM on the console, where *x* is the screen pair indicator (A,B,C,D,E) corresponding to the screen pair being calibrated.

See Job Card CAL 006 ”SCREEN PAIR SELECTION AND CONFIGURATION”.

At this point, enter the three parameter values by using the CHANGE key, rotating the kV dial and using the NEXT, VALID and SETUP keys. See sections 3–10–6 and 3–10–7.

If this is an additional Senographe 700T or 800T, at the same site, using the same processor, then as soon as the three parameter values are correctly entered, go IMMEDIATELY to the Job Card IST 014 ”CALIBRATION OF REFERENCE ENERGY FOR A GIVEN SCREEN PAIR”

Once this calibration is finished, go directly to step 17 below. Otherwise, go directly to Job Card IST 013 ”calibration of film reciprocity failure compensation for a given screen pair”. Once this calibration is finished, write down the newly–determined parameters A0, A1 and A2 for the screen pair being calibrated in table 1.

17. Change console dialog display language to that of the country of installation (if other than English):

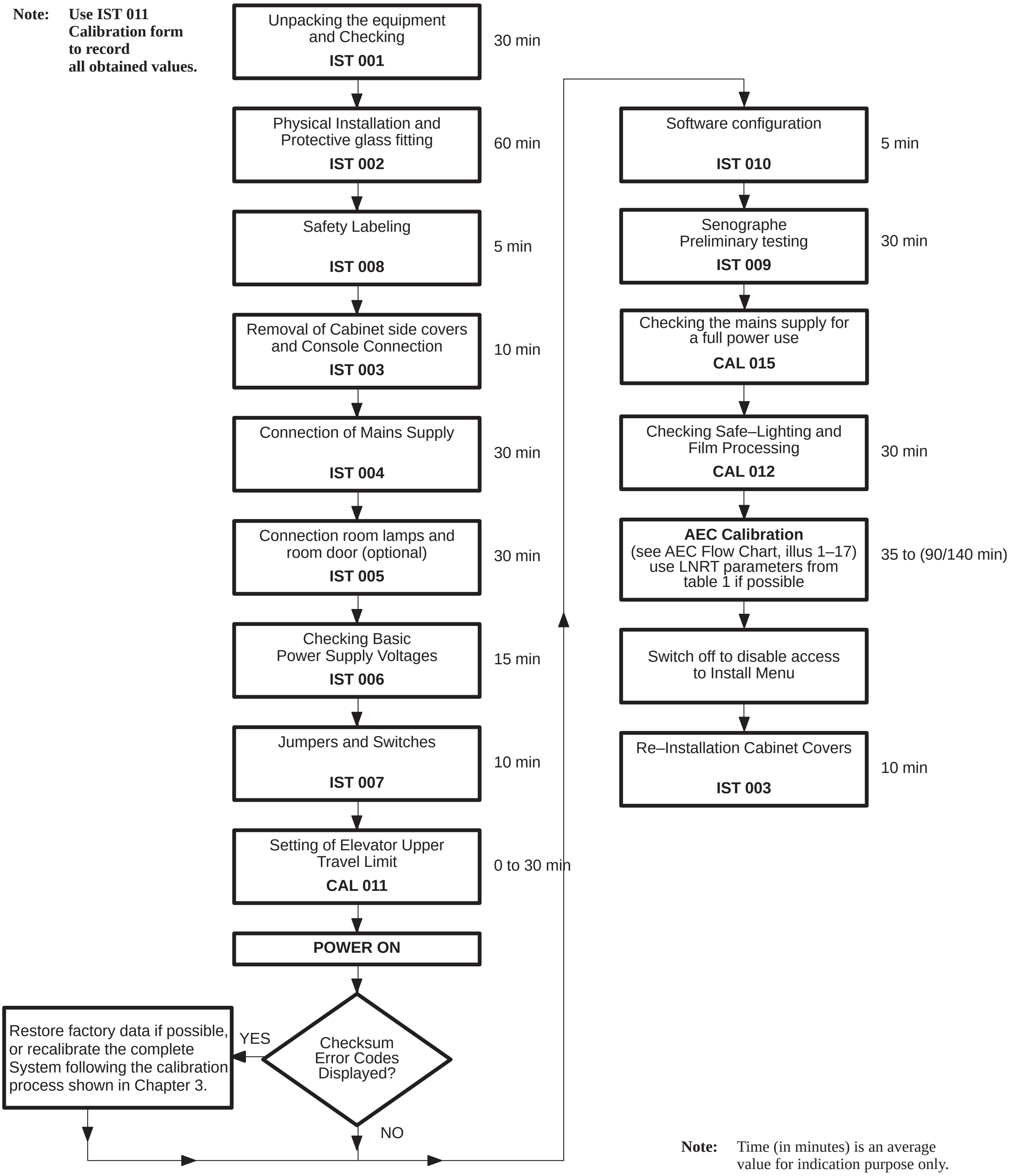
    Starting from application mode, select
    SETUP/MEDICAL/1/2/LANGUAGE/language on the console, where *language* is the desired console dialog display language (FRANC, ENGL, DEUTS, ESPAN, ITALIor PORTU).

18. Switch off the Senographe to disable access to Installation Menu.
19. Refit cabinet covers.

    See Job Card IST 003 ”REMOVING AND RE–INSTALLING THE CABINET COVERS AND CONSOLE CONNECTION”.

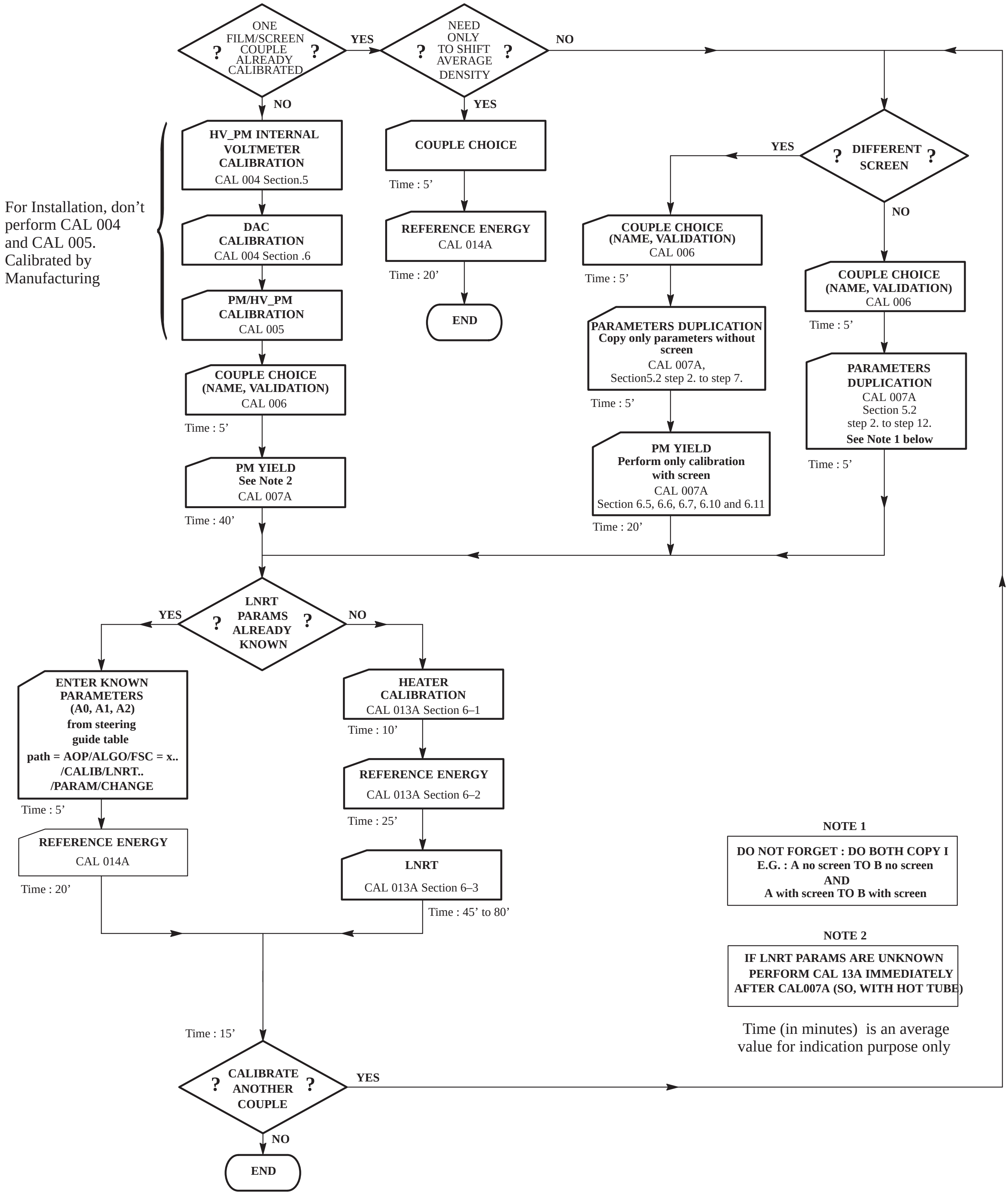
ILLUSTRATION 1–16
STEERING GUIDE FLOWCHART

Note: Use IST 011 Calibration form to record all obtained values.



Note: Time (in minutes) is an average value for indication purpose only.

ILLUSTRATION 1–17A
FLOW CHART OF AEC/AOP CALIBRATION (AVAILABLE FOR SOFTWARE LOWER OR EQUAL TO V2.21)



NOTE 1

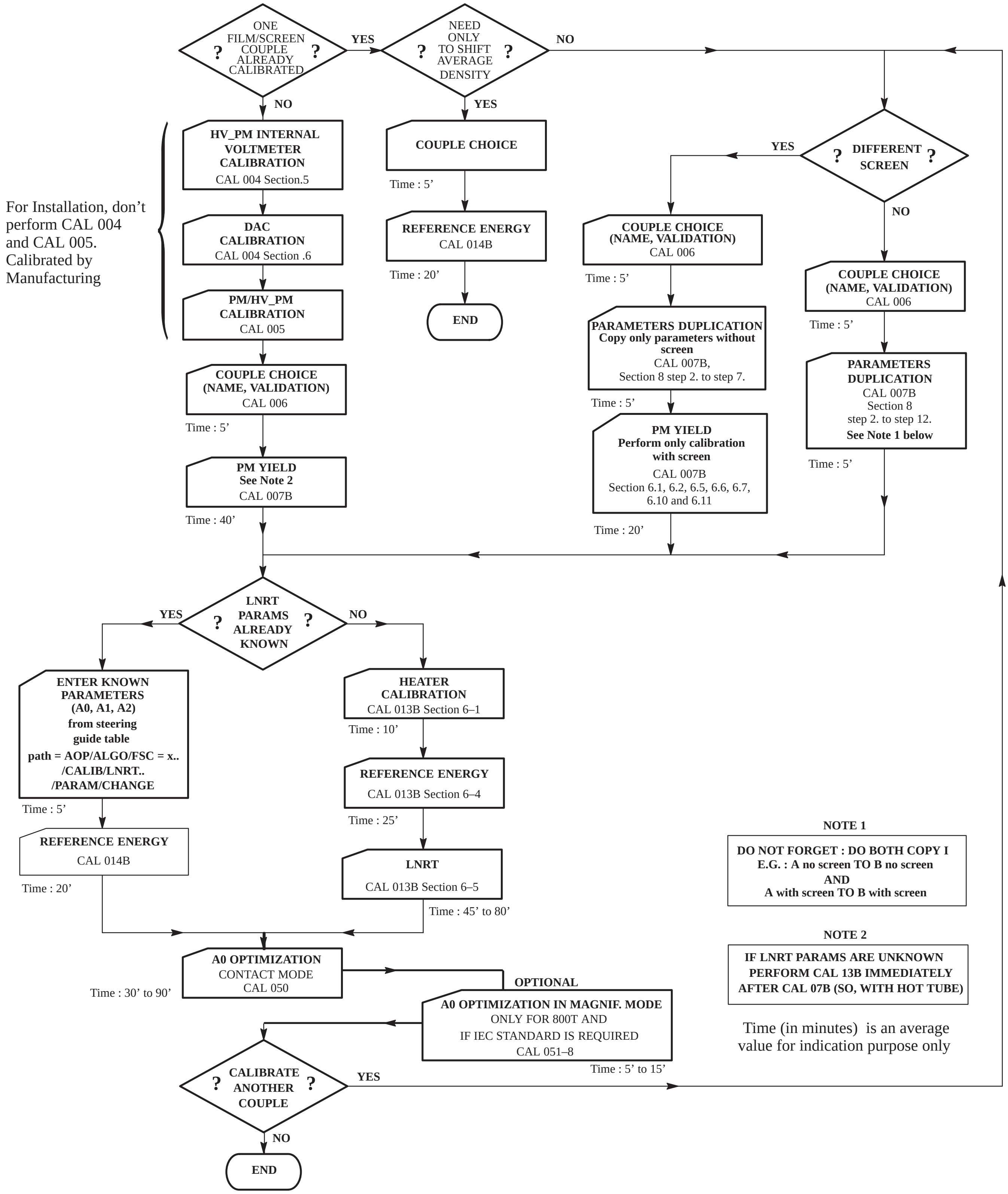
DO NOT FORGET : DO BOTH COPY I
E.G. : A no screen TO B no screen
AND
A with screen TO B with screen

NOTE 2

IF LNRT PARAMS ARE UNKNOWN
PERFORM CAL 13A IMMEDIATELY
AFTER CAL007A (SO, WITH HOT TUBE)

Time (in minutes) is an average value for indication purpose only

ILLUSTRATION 1–17B
FLOW CHART OF AEC/AOP CALIBRATION (AVAILABLE FOR SOFTWARE HIGHER OR EQUAL TO V2.31)



SECTION 6
INSTALLATION JOB CARDS

JOB CARD No.	PURPOSE
IST 001	UNPACKING THE EQUIPMENT AND CHECKING
IST 002	PHYSICAL INSTALLATION AND PROTECTIVE GLASS FITTING
IST 003	REMOVING AND RE–INSTALLING THE CABINET COVERS AND CONSOLE CONNECTION
IST 004	CONNECTION OF MAINS SUPPLY
IST 005	CONNECTING ROOM LAMPS AND ROOM DOOR (OPTIONAL)
IST 006	CHECKING BASIC POWER SUPPLY VOLTAGES
IST 007	JUMPERS AND SWITCHES
IST 008	SAFETY LABELLING
IST 009	SENOGRAPHE PRELIMINARY TESTING
IST 010	SOFTWARE CONFIGURATION
IST 011A	INSTALLATION FORM (FOR SYSTEMS WITH SOFTWARE <= V2.21)
IST 011B	INSTALLATION FORM (FOR SYSTEMS WITH SOFTWARE >= V2.31)

Senographe 700T and 800T	Job Card IST 001	1 of 2

Purpose: **UNPACKING THE EQUIPMENT AND CHECKING**	Version No.: Date: Dec. 18, 1995
Time: x h xx min	Personnel:

SECTION 1
SUPPLIES

None.

SECTION 2
TOOLS

- Ratchet wrench with 22 mm socket.
- 6mm Allen wrench.
- Claw hammer or other suitable tool for removing packing nails.

SECTION 3
SADETY PRECAUTIONS

Follow standard safety pratices for handling and moving large machines.

CAUTION

Never lift or move the Senographe by its the arm handles and by the image receptor.

SECTION 4
PREREQUISITES

None.

UNPACKING THE EQUIPMENT AND CHECKING Job Card IST 001 2 of 2

SECTION 5
UNPACKING THE EQUIPMENT

The objective is to unpack the Senographe and accessories from the crate, move them to the mammography room and checking quickly the content of each accessory boxes.

5.1 Inpect for damage and perform initial unpacking

The Senographe was completely inspected for proper operation and appearance before shipment. However, it is necessary to inspect the product after the shipment is received. Visually inspect the packages for any apparent damage. If there are signs of damage, refer to the Damage in Transportation statement in the front of this manual.

5.2 Unpacking equipment

1. Remove the accessory packages from the palette.
2. Use the ratchet wrench with a 13 mm socket to remove the four Senographe baseplate shipping hold hold–down screws.
3. Remove the four wooden support blocks in place between the palette and the Senographe baseplate.

Note: Keep one of four wooden support blocks because it will be used to install the protective glass.

4. When the Senographe is fully supported by the castors, take the Senographe down from the palette in using the ramp.

CAUTION **Never lift or move the Senographe by its the arm handles and by the image receptor.**

5. Move the Senographe and the other accessory packages into mammography room.
6. Open the main accessory package and refer to the check list. Verify the items on the list, are present in the packages. Each package is numbered. Carefully examine the contents for small parts.

Senographe 700T and 800T	Job Card IST 002	1 of 4

Purpose: **PHYSICAL INSTALLATION AND PROTECTIVE GLASS FITTING**	Version No.: A Date: Dec. 18, 1995
Time: 1 hour	Personnel:

SECTION 1
SUPPLIES

None

SECTION 2
TOOLS

- Rachet wrench with 17 mm socket
- 8 mm Allen wrench
- 5 mm Allen wrench
- Screwdrivers

SECTION 3
SAFETY PRECAUTIONS

Follow standard safety pratices for handling and moving large machines.

CAUTION

Never lift or move the Senographe by its the arm handles and by the image receptor.

SECTION 4
PREREQUISITES

- Job Card IST 001 ”UNPACKING THE EQUIPEMENT AND CHECKING”
- Job Card IST 003 ”REMOVAL OF ELECTRONIC CABINET COVERS” (Section 5 point 5.1 only).

PHYSICAL INSTALLATION AND PROTECTIVE GLASS FITTING Job Card IST 002 2 of 4

SECTION 5
PHYSICAL INSTALLATION

The objective is to physical place the Senographe in its position, and to fit the protective.

5.1 Install the Senographe into its position.

Note: Before you proceed, it is recommended to perform a final verification of the information given in the Pre–Installation Manual.

1. Wheel the Senographe to the right position.
2. Detach the protective glass from the Senographe and put it safe area.
3. Remove the protective glass holder fixed on the castor.
4. Place the four flat round jack feet on the floor with their nipples facing upwards.
5. Turn the four jacking bolts downwards until their hollowed ends engage with the nipples of the four jack feet.
6. Use the rachet wrench with 17 mm socket to progressively jack the Senographe up via the four jacking bolts until the castors are clear of the floor.
7. Use the 8 mm Allen wrench to remove the castors.
8. Lower the Senographe progressively via the four jacking bolts until it is fully supported by its baseplate. Remove the four jacking bolts completely.

Note: The four jack feet remain below the Senographe baseplate.

9. Install the four short leveling screws into the jacking holes and adjust till the Senographe 700T and 800T is level. It is NOT necessary to perfectly level the base, only to ensure it is sitting firmly on all four jacking feet and approximatly level.
10. Cover all base plate holes external to the cabinet with the plastic caps provided.

CAUTION **Remove locking rods for column movements.**

11. Put in place the appropriate caps to hide the locking rod holes (caps are delivered in the installation kit).
12. Save castors, jacking bolts, the wooden block and locking rods for future service needs.

PHYSICAL INSTALLATION AND PROTECTIVE GLASS FITTING

Job Card IST 002

5.2 Fit the protective glass.

CAUTION **The glass weighs 40 kg and should, therefore, be handled with care.**

1. Unpack the protective glass.
2. Mount the protectrive glass attachment rail with four screws from installation kit.
3. Referring to Illustration 1 for details, assemble four mounting screw assemblies (A) as shown at B in the holes at the edge of the glass (the other two are for the control panel holder).
4. Place the protective glass on the wooden block (from the Senographe packaging) and slide it carefully up to the mounting bracket on the column.
5. Position the protective glass so that you can slide the screws into their securing holdes (arrow 1 in Illustration 2)
6. Position the glass so that you can slide the screws into their securing holes (arrow 1 in Illustration 2).

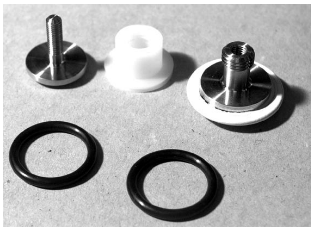
WARNING **MAKE SURE ALIGNMENT OF THE PLASTIC PARTS WITH THE SCREWS IS PERFECT TO AVOID DAMMAGE OF THREATS.**

7. Making sure the black gaskets (see arrows 1 in Illustration 1) remain in place, tighten the four screws securely.
8. Position the supporting foot (arrow 2 in Illustration 2) with the shaped gaskets between the glass and the foot, and the shaped metal piece between the Allen screws and the gasket.
9. Remove the wooden block and adjust the height of the foot until it is just supporting the weight of the glass, then tighten the Allen screw on the moveable part of the foot.
10. Place the two remaining screw assemblies in the holes in the middle of the glass (arrow 3 in Illustration 2) and mount the control panel holder.
11. Slide the control panel into this holder.

PHYSICAL INSTALLATION AND PROTECTIVE GLASS FITTING Job Card IST 002 4 of 4

ILLUSTRATION 1
GLASS MOUNTING SCREW ASSEMBLY

A



B

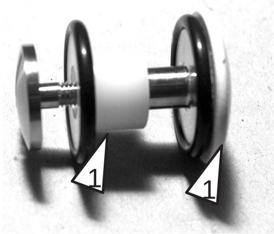
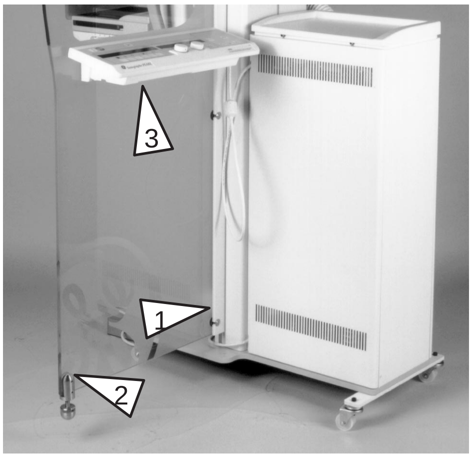
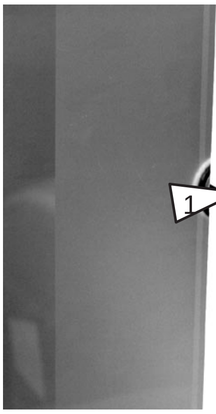
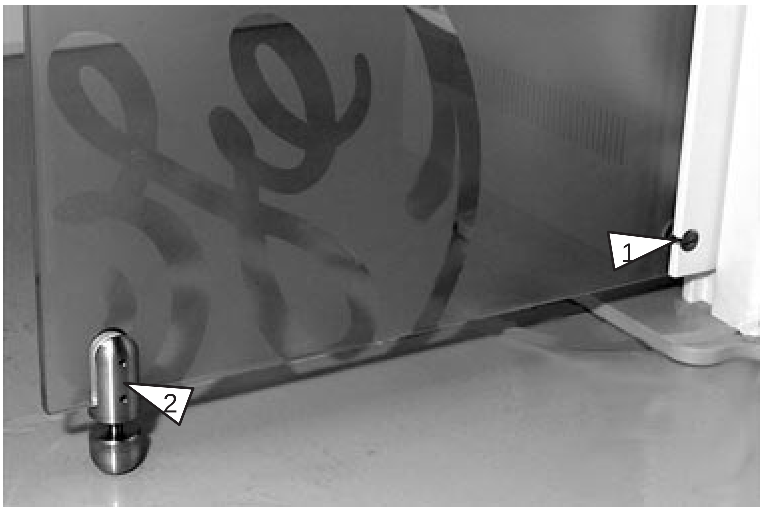


ILLUSTRATION 2
LOCATION OF SECURING PARTS ON THE GLASS







Senographe 700T and 800T Job Card IST 003

Purpose: **REMOVING AND RE–INSTALLING THE CABINET COVERS AND CONSOLE CONNECTION**	Version No.: Date: Dec. 18, 1995
Time: 10 min	Personnel:

SECTION 1
SUPPLIES

None.

SECTION 2
TOOLS

Engineer’s standard toolkit.

SECTION 3
SPECIAL SAFETY PRECAUTIONS

None.

SECTION 4
PREREQUISITTES

The chronological order given (see Section 5, in Chapter 1, ”INSTALLATION STEERING” must be followed).

REMOVING AND RE–INSTALLING THE CABINET COVERS AND CONSOLE CONNECTION Job Card IST 003

SECTION 5
TASK DESCRIPTION

The objective is to remove, re–install the cabinet covers and to connect the console.

5.1 Removing the covers

There are three covers on the cabinet – the top cover clips on and the two side covers are held by screws accessible when the top has been removed.

1. To remove the top cover, pull upwards in the areas shown by arrows 1 – it may be necessary to give a sharp tug to pull it free of the retaining clips.
2. Unscrew the two screws (location shown by arrows 2) on each side cover and lift the covers, one at a time, free of the pins holding the bottom edge in place – disconnect the grounding wires and remove the panels to a safe place.

5.2 Routing and connecting console cable

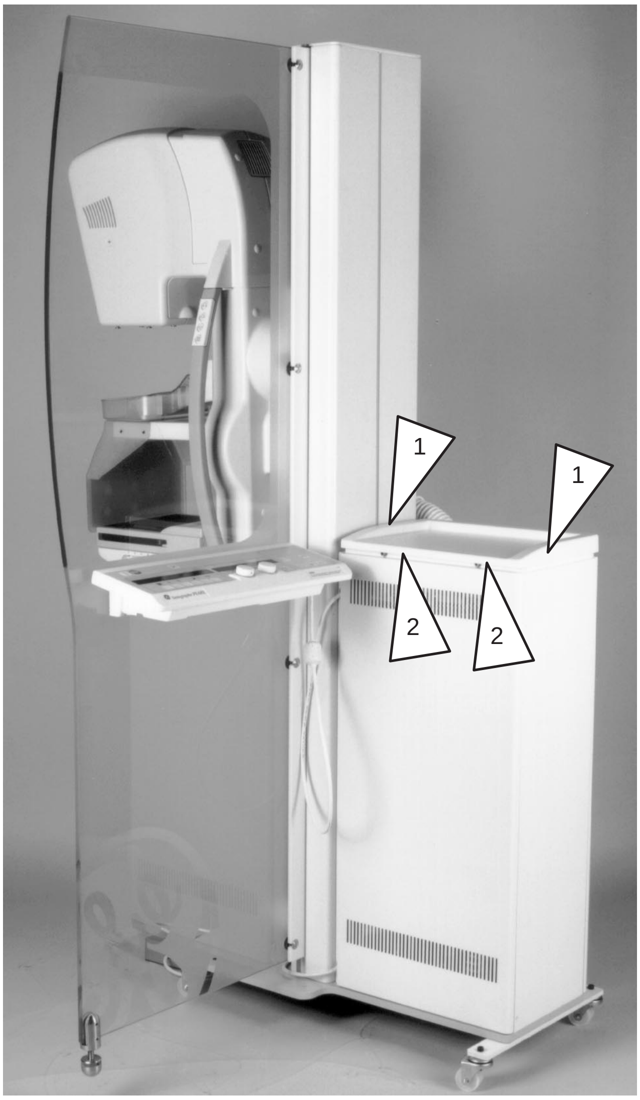
1. Locate connector J5 on 300PL9 Power Supply Board and connect the console cable to it (see illustration 4).
2. Route console cable (provided in the accesssory pack) as show Illustration 3, arrows 3.
3. Connect opposite end of console cable to the console.

5.3 Re-installing the covers

Re-installing the covers is the reverse order of removal (see Section 5.1).

REMOVING AND RE–INSTALLING THE CABINET COVERS AND CONSOLE CONNECTION	Job Card IST 003	3 of 4

ILLUSTRATION 3
REMOVING THE COVERS

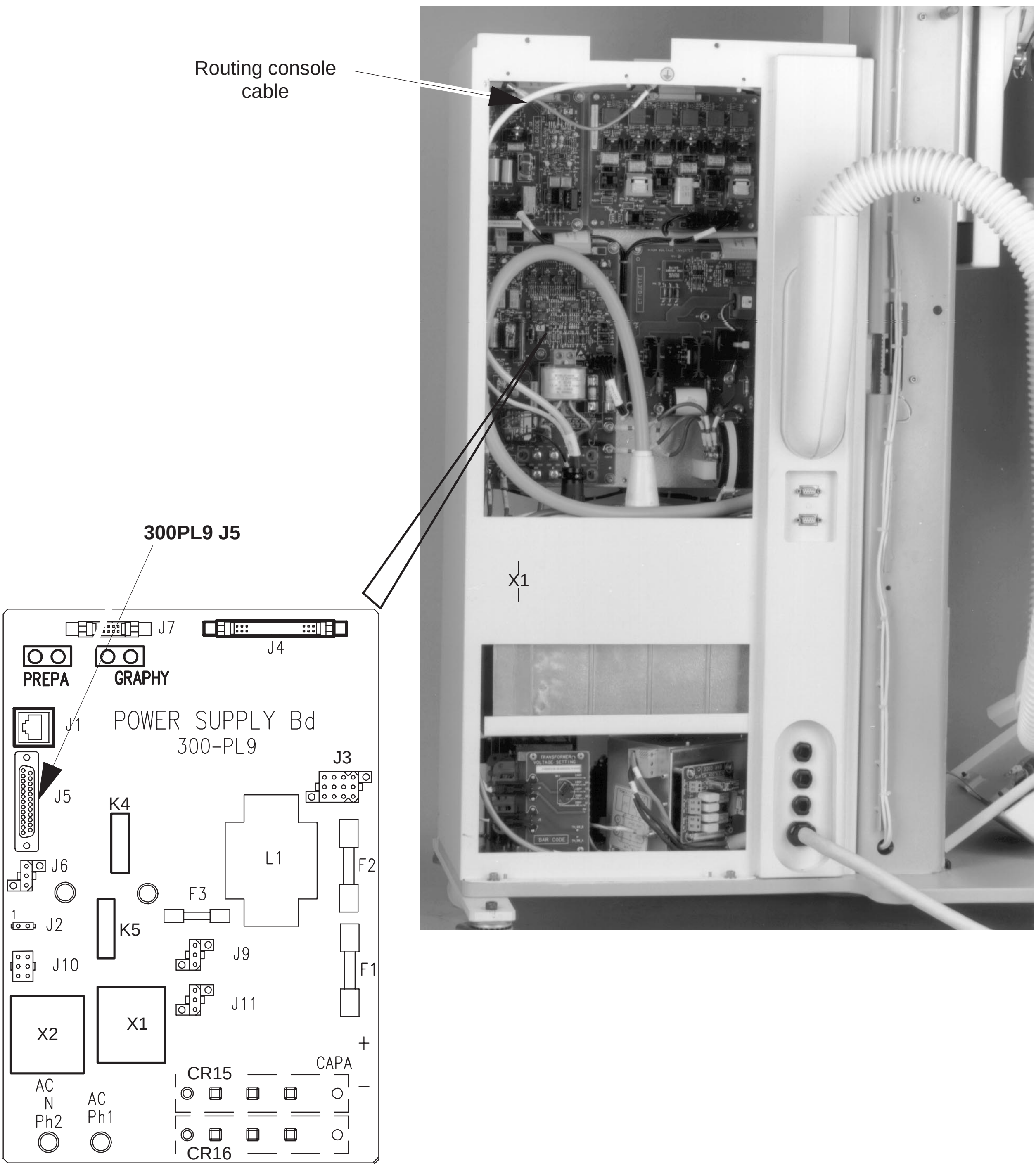


INSTALLATION

REMOVING AND RE–INSTALLING THE CABINET COVERS AND CONSOLE CONNECTION

Job Card IST 003

ILLUSTRATION 4
CABLE ROUTING



Senographe 700T and 800T Job Card IST 004

Purpose: **CONNECTION OF MAINS SUPPLY**	Version No.: Date: Dec. 18, 1995
Time: 30 min	Personnel:

SECTION 1
SUPPLIES

None.

SECTION 2
TOOLS

- A.C. voltmeter.
- Pliers (for cable clamp).

SECTION 3
SAFETY PRECAUTIONS

Follow standard safety techniques and procedures for handling equipment and circuits that can come into contact with mains supply voltages.

SECTION 4
PREREQUISITES

The chronological order given in Installation Steering Guide must be followed.

SECTION 5
CONNECTION OF MAINS SUPPLY

The objective is to determine characteristics (i.e. nominal voltage and number of phases) of the available power source, configure the Senographe accordingly, and connect it to the power source.

5.1 Determine if available mains supply is one phase and neutral or two phases

If one phase and neutral mains supply is available in the mammography room, use the phase and the neutral to power the Senographe by wiring it according to the Illustration 1.

Verify that the wire from the hospital power marked as neutral is in fact neutral.

If two phases are available, wire the Senographe according to the Illustration 2.

Take special care to configure F1, F2 or the metal cylinder as specified in Section 5.4.

ILLUSTRATION 1
ONE PHASE AND NEUTRAL MAINS SUPPLY

CONNECTION OF MAINS SUPPLY

Job Card IST 004

ILLUSTRATION 2
TWO PHASES MAINS SUPPLY

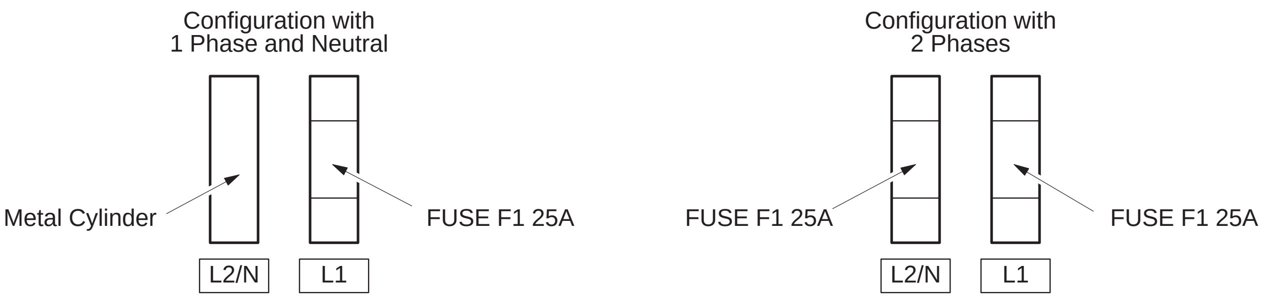
5.2 Configure Fuses F1, F2 or the metal cylinder

Follow the indications on the label located on the bottom of the cabinet on the Mains Fuse Disconnector 300 S1, for the configuration. Also see Illustration 3 below.

WARNING

TO ASSURE SAFE OPERATION OF THE SENOGRAPHE. BE SURE TO DETERMINE IF THE MAINS SUPPLY CONSISTS OF TWO PHASES OR A SINGLE PHASE WITH NEUTRAL. FOR A SINGLE–PHASE WITH NEUTRAL MAINS SUPPLY, A METAL CYLINDER (DELIVERED WITH THE SENOGRAPHE) MUST BE INSTALLED IN PLACE OF F2.

ILLUSTRATION 3
FUSE CONFIGURATION



CONNECTION OF MAINS SUPPLY

Job Card IST 004

5.3 Route and connect mains cable

1. Verify that mains fuse Disconnector 300 S1 is opened (i.e. Fuses visible) and that mains source is turned OFF.

Note: It is important mains fuse Disconnector 300 S1 stays open until Section 5.6 of this procedure. Damage to 30 volts power supply may result if mains fuse Disconnector 300 S1 is closed before setting 300PL18 SK1.

2. Route mains cable into the cabinet, via the mains input side, as shown in Illustration 4, item 1.
3. Connect mains cable conductors (One phase and Neutral or two phases, and ground) to connector 300 J1 as shown as shown as in Illustration 4, item 1.

Note: Firmly tighten the three conductors and check that they are tight by pulling on them.

4. Arrange mains cable conductors neatly, install the cable clamp around the cable and into the cover of cabinet, as shown as in Illustration 4, item 2.

ILLUSTRATION 4
POSITION OF MAINS CABLE AND CABLE CLAMP

5. Route and connect other end of mains cable to mains source.

5.4 Check nominal line voltage

Consult the user or the local electrical utility to determine nominal line voltage.

Measure open–circuit line voltage. Verify that it corresponds to the nominal line voltage (as determined above) ± 10%. Possible nominal line voltages are 200, 208, 220, 230, 240 for mono–phase and bi–phases.

Write down the open–circuit line voltage in the IST 011 ”INSTALLATION FORM”

5.5 Position voltage selection jumper

Position the voltage selection jumper SK1 onto the 300PL18 Transformer Voltage Setting Board according to nominal mains voltage. It is important to use the nominal line voltage and not the open circuit voltage, if they are different. See Table 1 below.

TABLE 1
300PL18 SK1 POSITIONS

NOMINAL MAINS VOLTAGE AND NUMBER OF PHASES	POSITION OF SK1 JUMPER ONTO 300PL8 TRANSFORMER VOLTAGE SETTING BOARD
200 V MONO–PHASE or BI–PHASE	200V
208 V MONO–PHASE or BI–PHASE	208V
220 V MONO–PHASE or BI–PHASE	220V
230 V MONO–PHASE or BI–PHASE	230V
240 V MONO–PHASE or BI–PHASE	240V

5.6 Mains fuse disconnector

1. Close mains fuse Disconnector 300S1.

WARNING

THE LOW VOLTAGE POWER SUPPLY IS NOW ENERGIZED.

WARNING

IF THE INCOMING LINE CONSISTS OF TWO HOT PHASES, THEN THE L2 SIDE OF THE DC BUS HAS LINE POTENTIAL ON IT. USE EXTREME CAUTION WHEN NEAR THE DC BUS.

CONNECTION OF MAINS SUPPLY

Job Card IST 004

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Senographe 700T and 800T	Job Card IST 005	1 of 6

Purpose: **CONNECTING ROOM LAMPS AND ROOM DOOR (OPTIONAL)**	Version No.: Date: Dec. 18, 1995
Time: x h xx min	Personnel:

SECTION 1
SUPPLIES

The necessary hardware (wires, lamp, switches...) is field or/and customer supplied.

SECTION 2
TOOLS

None.

SECTION 3
SPECIAL SAFETY PRECAUTIONS

None.

SECTION 4
PREREQUISITES

None.

CONNECTING ROOM LAMPS AND ROOM DOOR (OPTIONAL)

Job Card IST 005

SECTION 5
PROCEDURE

1. Referring to Illustration 1 for details, connect the room and lamps wiring to XJ1, XJ2, XJ3 (location shown in Illustration 3) on the 300PL4 board.
2. Route the wires in the cabinet, along with the mains supply cable.

ILLUSTRATION 1
WIRING OF THE ROOM LAMPS AND DOOR

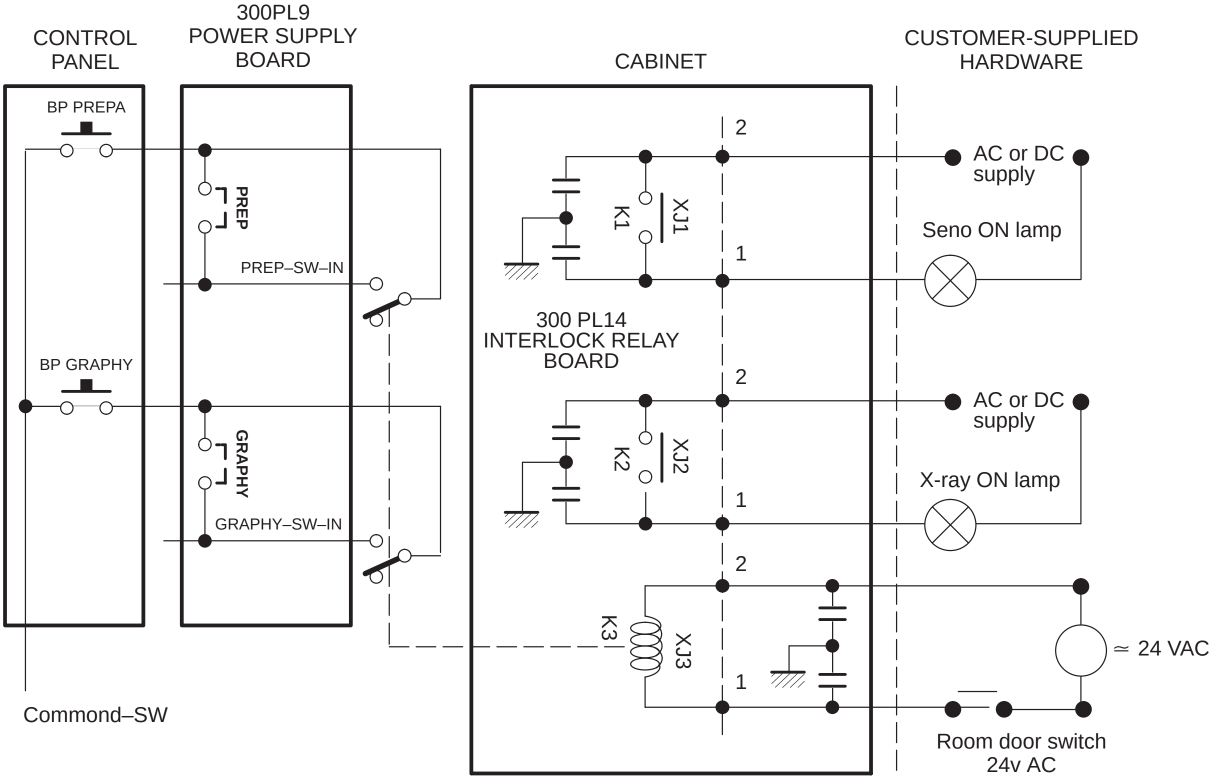
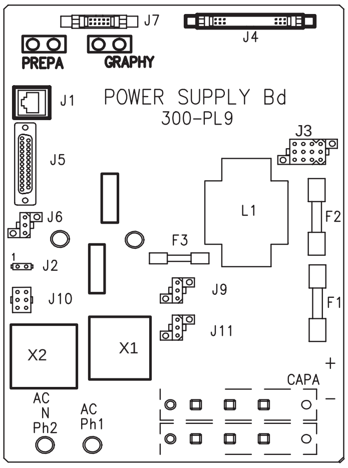


ILLUSTRATION 2
300PL9 POWER SUPPLY BOARD – LOCATION PREPA AND GRAPHY JUMPERS



3. Locate the 300PL9 POWER SUPPLY Board and position the PREP and GRAPHY jumpers following the Table 1.

TABLE 1

PREPA JUMPER	GRAPHY JUMPER	DOOR CLOSED	DOOR OPENED
0	0	PREP and GRAPHY enabled	PREP and GRAPHY disabled
0	1	PREP and GRAPHY enabled	PREP and GRAPHY disabled (see Note 1)
1	0	PREP and GRAPHY enabled	PREP enabled GRAPHY disabled
1	1	PREP and GRAPHY enabled	PREP and GRAPHY enabled

0 = Jumper removed
1 = Jumper in its place

Note 1: If the door is opened during the exposure, it will NOT be aborted, it will be finished normally.

Note 2: The load current rating of the relays K1 and K2 on 300PL14 is:

– 8A @ 250 AC

– 8A @ 30 DC

The relay K3 must be supplied with 24 VAC.

CONNECTING ROOM LAMPS AND ROOM DOOR (OPTIONAL)	Job Card IST 005	4 of 6

ILLUSTRATION 3
LOCATION OF ROOM WIRING CONNECTORS

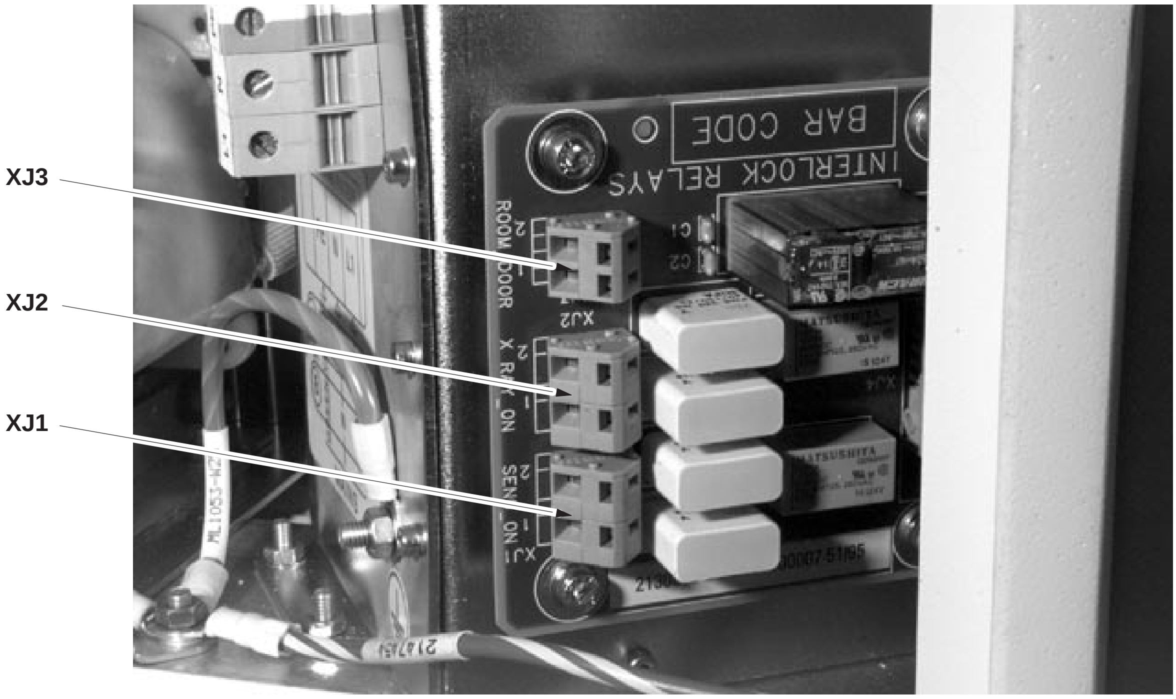
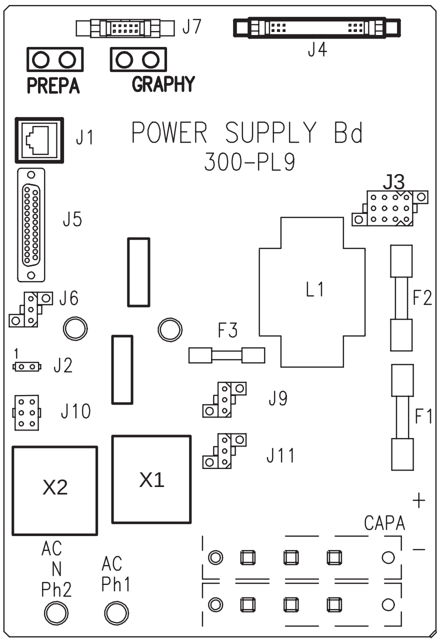
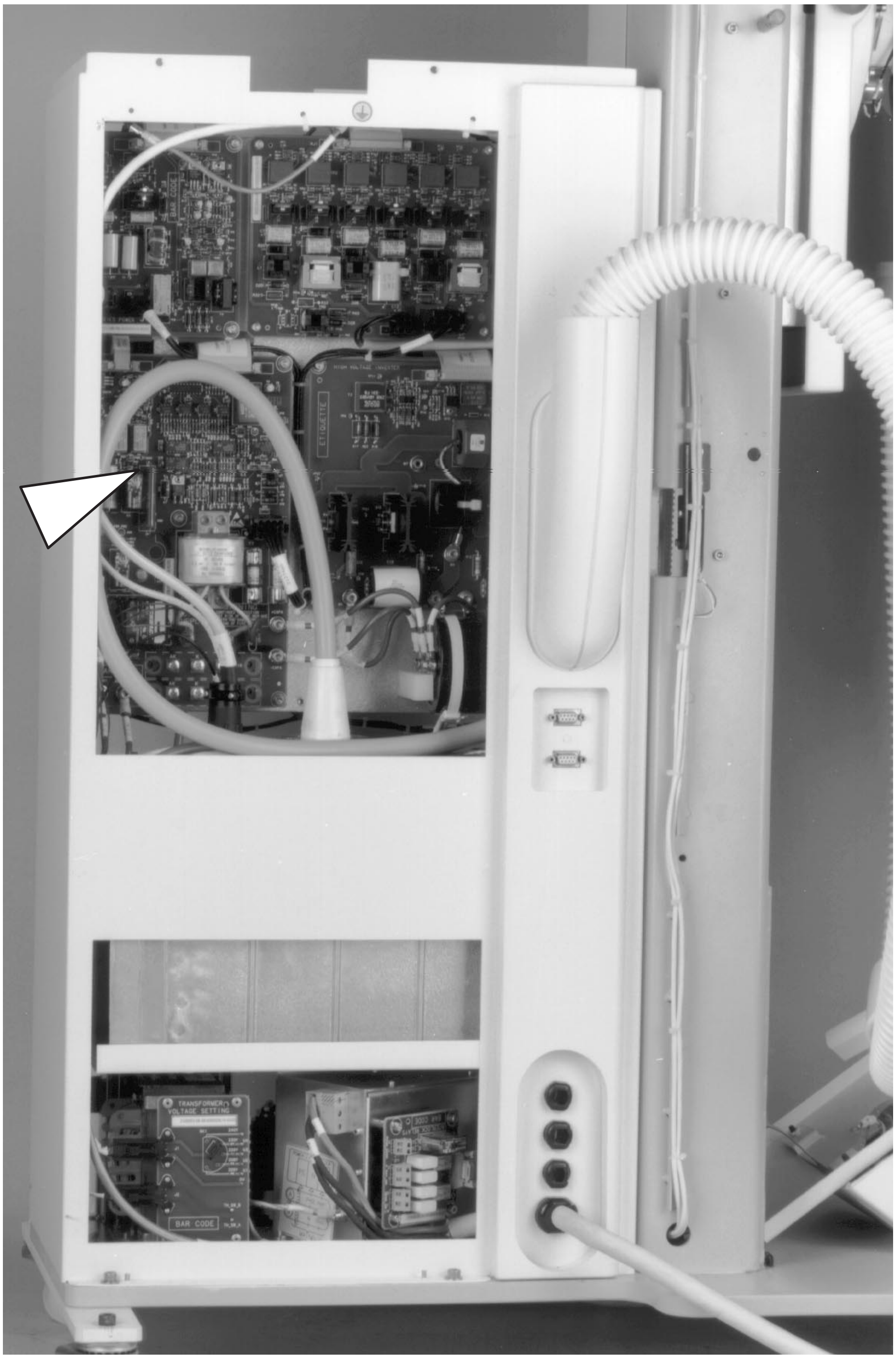


ILLUSTRATION 4
300PL9 POWER SUPPLY BOARD – LOCATION OF J1 TO J4



CONNECTING ROOM LAMPS AND ROOM DOOR (OPTIONAL) Job Card IST 005

ILLUSTRATION 5
300PL9 BOARD LOCATION



CONNECTING ROOM LAMPS AND ROOM DOOR (OPTIONAL)

Job Card IST 005

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Senographe 700T and 800T Job Card IST 006

Purpose: **CHECKING BASIC POWER SUPPLY VOLTAGES**	Version No.: Date: Dec. 18, 1995
Time: 15 min	Personnel:

SECTION 1
SUPPLIES

None.

SECTION 2
TOOLS

Accurate digital voltmeter (Fluke 87 or equivalent).

SECTION 3
SAFETY PRECAUTIONS

None.

SECTION 4
PREREQUISITES

None.

SECTION 5
FIRST POWER–ON CHECK

The objective in this section is to detect any incorrect low voltage.

5.1 Check low voltages +5VS and ± 15VS.

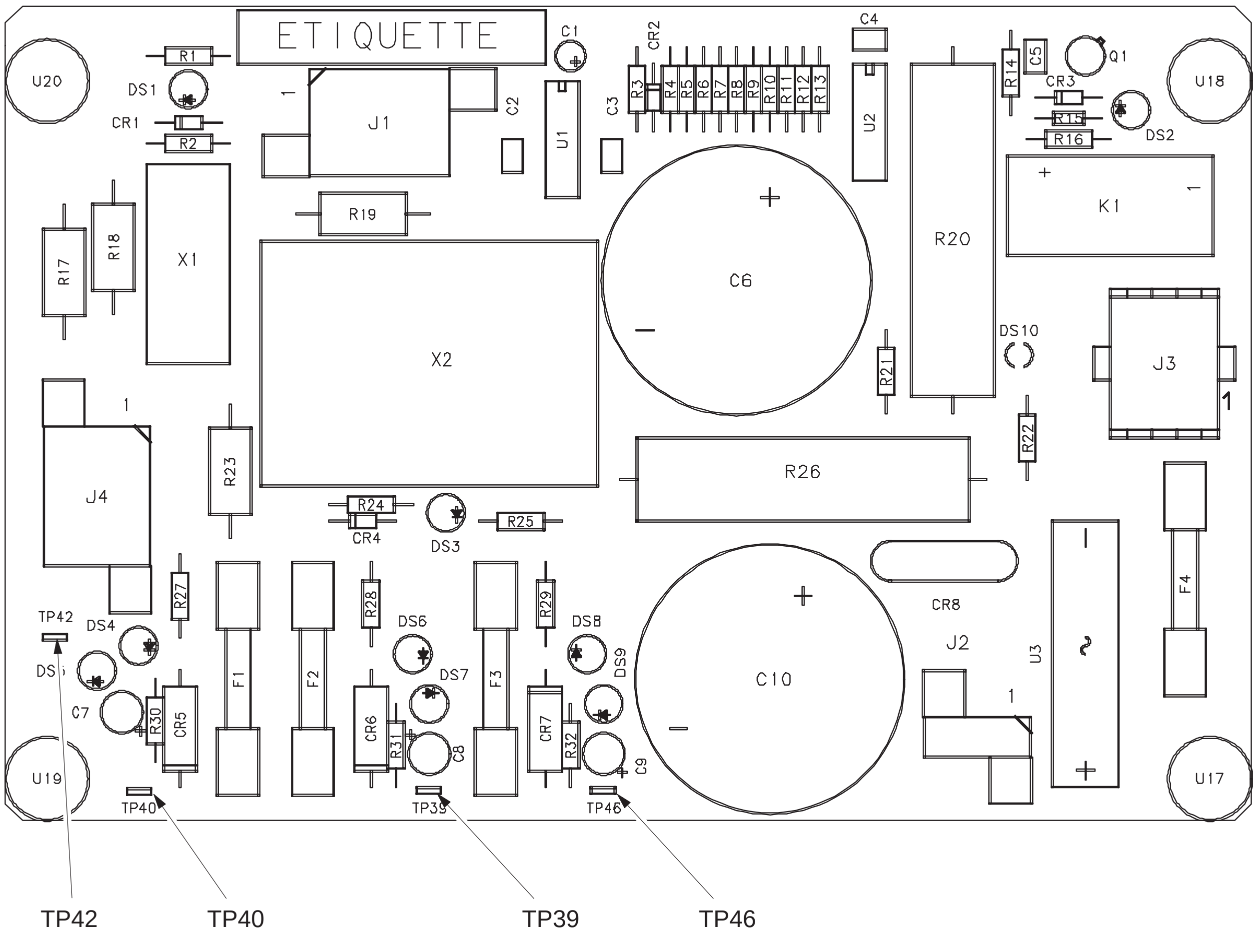
1. Check +5VS:
   - Check that Mains Supply Disconnector 300 S1 is open.
   - Connect the voltmeter (set to 20 VDC scale) between TP39 (+5VS) and TP42 (GND)on 300PL17 Low Voltage Distribution Board (see illustration 1).
   - Close Mains Supply Disconnector 300 S1.
   - Voltage +5VS should be in the range +5.2 to 5.25 VDC.

Note: This voltage can be adjusted via the potentiometer located on the Low Voltage Power Supply and in performing the JOB CARD CAL 024 ”+5V LVPS ADJUSTMENT”.

CHECKING BASIC POWER SUPPLY VOLTAGES Job Card IST 006

2. Check +15VS:
   - Check that Mains Supply Disconnector 300 S1 is open.
   - Connect the voltmeter (set to 20 VDC scale) between TP40 (+15VS) and TP42 (GND) on 300PL17 Low Voltage Distribution Board (See Illustration 1).
   - Close the Mains Supply Disconnector 300 S1.
   - The voltage should be in the range + 13.5 to + 16.5VDC.

ILLUSTRATION 1
LOCATION OF TEST POINTS PT39, PT40, PT42, AND PT46 FOR CHECKING KEEP–ALIVE SUPPLY VOLTAGE ON DISTRIBUTION BOARD 300PL17



3. Check –15VS:
   - Check that Mains Supply Disconnector 300 S1 is open.
   - Connect the voltmeter (set to 20 VDC scale) between TP46 (–15VS) and TP42 (GND) on 300PL17 Low Voltage Distribution Board (See Illustration 1).
   - Close the Mains Supply Disconnector 300 S1.
   - The voltage should be in the range –13.5 to –16.5 VDC.

Note: The voltages measured in Sections 5.1.2 and 5.1.3 above depend on the +5VS adjustment mentioned in Section 5.1.1.

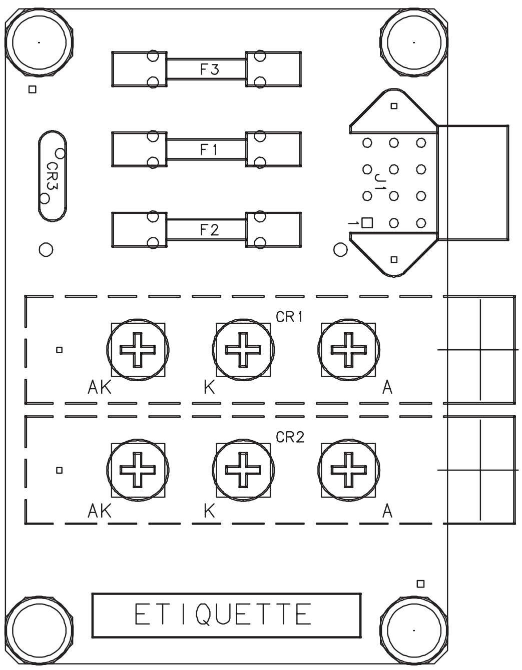
4. Check in charge:
   - Perform Job Card CAL 024 sections 5.3 and 5.4.

5.2 Check Gantry DC supply voltages

1. Switch ON the console and connect a voltmeter(set to DCV scale) on 300PL13 Gantry Power Supply Board, between CR2 K and CR2 A (Head of screws). See Illustration2.
2. The voltage should be in the range +22 to +35 VDC.
3. Switch OFF the console.

5.3 Report all Measured values in IST 011 "INSTALLATION FORM"

ILLUSTRATION 2
300PL13 BOARD (CR2 A AND K)



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Senographe 700T and 800T Job Card IST 007

Purpose: **JUMPERS AND SWITCHES**	Version No.: 1 Date: Dec. 18, 1995
Time: 5 min	Personnel: 1

SECTION 1
SUPPLIES

None.

SECTION 2
TOOLS

None.

SECTION 3
SAFETY PRECAUTIONS

None.

SECTION 4
PREREQUISITES

None.

SECTION 5
JUMPERS AND SWITCHES

The objective is to verify the position of jumpers and switches. Jumpers and switches are divided into two groups:

- Cabinet.
- Console.

5.1 Cabinet jumpers and switches.

1. 200PL3 Bucky command board: Switch U14 must be opened.
2. Check that the jumper on generator CPU board 300PL4 is installed in position X2. See Illustration 1.

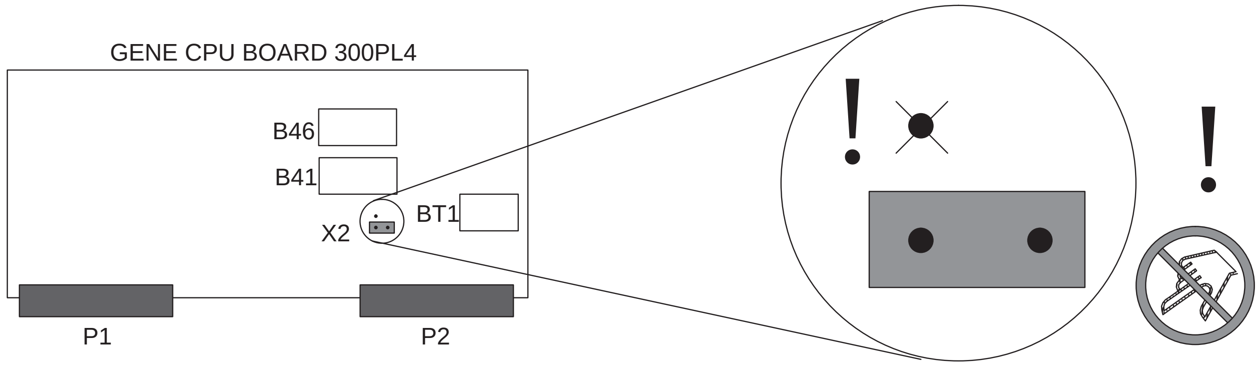
JUMPERS AND SWITCHES

Job Card IST 007

CAUTION

This jumper must NEVER be removed from position X2 and must NEVER be placed in position TP1. If you find this jumper either removed or placed in position TP1, the generator CPU RAMs are totally erased, necessitating a TOTAL RE–CALIBRATION of the generator and AEC.

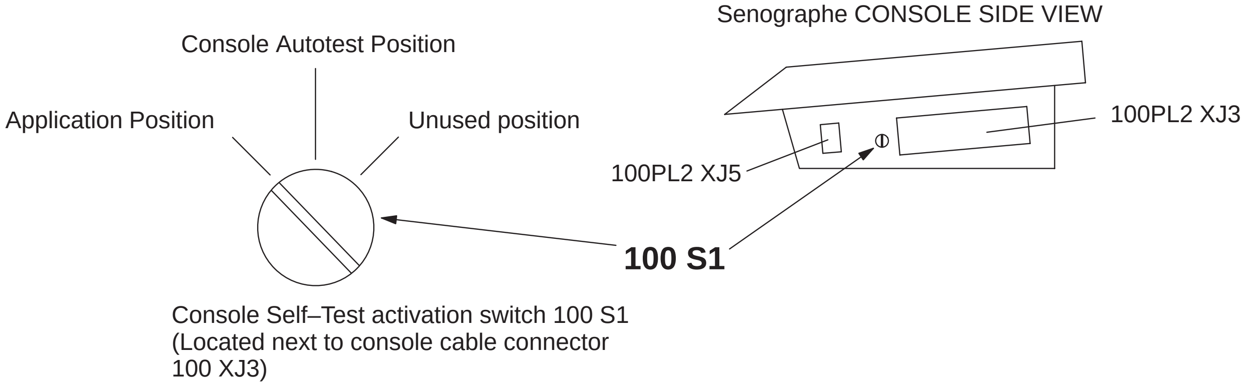
ILLUSTRATION 1
POSITION OF JUMPER ON GENERATOR CPU BOARD 300PL4



3. Console self–test activation switch.
4. Check that console self–test activation switch 100 S1 is in its ”application position”. See Illustration 2.

Note: When this switch is in its ”unused” position, the console display stays blank and ”beeps” at 1–second intervals after power on is pressed.

ILLUSTRATION 2
CONSOLE SELF–TEST ACTIVATION SWITCH 100 S1



5. 300PL8: TP25 in place. Do not make a strapp in TP26. SK1 must be in place.
6. 300PL9: Jumper prepa to allow prepa. Jumper graphy to allow graphy.

Senographe 700T and 800T Job Card IST 008

Purpose: **SAFETY LABELLING**	Version No.: 0 Date: Dec. 18,1995
Time: 45 to 75 min	Personnel: 1

SECTION 1
SUPPLIES

None.

SECTION 2
TOOLS

None.

SECTION 3
SAFETY PRECAUTIONS

CAUTION

The attachment of appropriate safety labelling to the equipment is a LEGAL REQUIREMENT for operation of an X–ray producing unit.

SECTION 4
PREREQUISITES

None.

SECTION 5
SAFETY LABELLING

The objective is to select and attach appropriate safety labels to the Senographe, according to local safety regulations concerning the use of X–ray producing equipment.

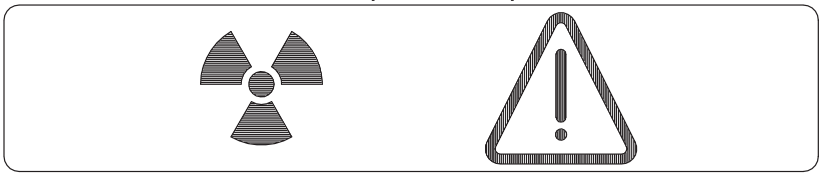
SAFETY LABELLING

Job Card IST 008

5.1 Locate the plastic pouch containing the 3 possible safety labels in the console packaging and select the one that corresponds to local regulations (see Illustration 1 below).

ILLUSTRATION 1
SAFETY LABELS

CEI (EUROPE)



REDAC (CANADA)

CDRH (USA)

"WARNING:

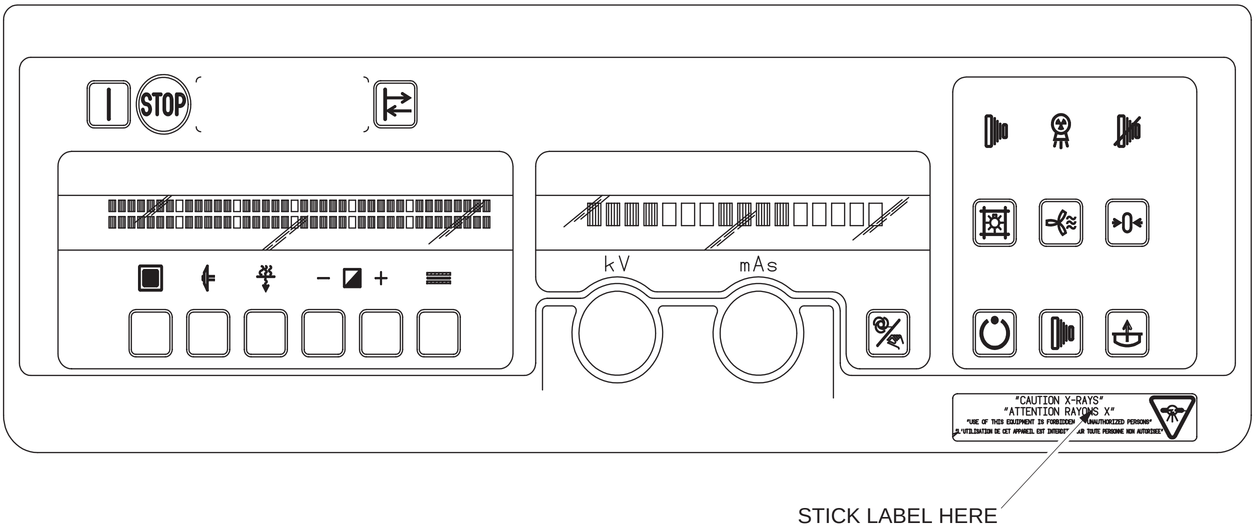
THIS X-RAY UNIT MAY BE DANGEROUS TO PATIENT AND OPERATOR UNLESS SAFE EXPOSURE FACTORS AND OPERATING INSTRUCTIONS ARE OBSERVED"

SAFETY LABELLING

Job Card IST 008

5.2 **Peel off the self–adhesive backing from the selected safety label, and stick the label onto the indented rectangular area intended for this purpose in the lower right–hand corner of the console. See Illustration 2.**

ILLUSTRATION 2
PLACEMENT OF SAFETY LABEL ON CONSOLE



5.3 **Locate the plastic pouch containing the following label in protective glass accessories package. See illustration 3.**

ILLUSTRATION 3
LEAD EQUIVALENT LABEL

SAFETY LABELLING

Job Card IST 008

5.4 **Peel off the seft adhesive backing from the label, and stick the label on the protective glass. See illustration 4.**

ILLUSTRATION 4
PLACEMENT OF LEAD EQUIVALENT LABEL ON PROTECTIVE GLASS

Note: Section 5.5 and 5.6 for US only.

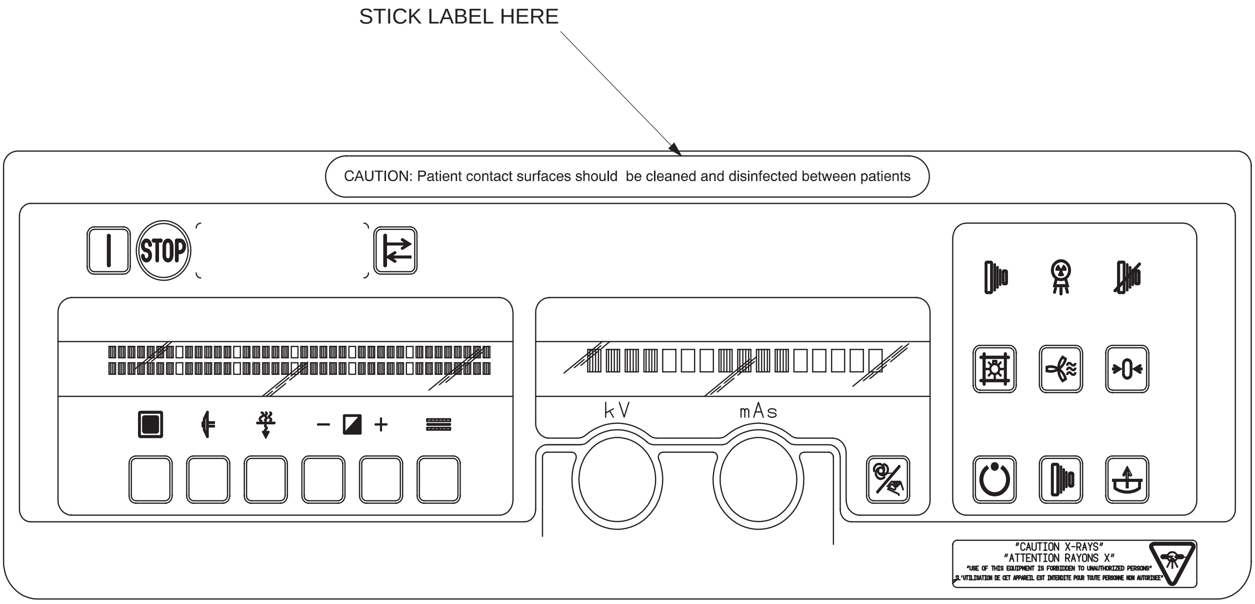
5.5 Locate the plastic pouch containing the following label in the console packaging. See Illustration 5.

ILLUSTRATION 5
US LABEL

CAUTION: Patient contact surfaces should be cleaned and disinfected between patients

5.6 Peel off the seft–adhesive backing from the label, and stick the label centering in the upper part of the console. See Illustration 6.

ILLUSTRATION 6
PLACEMENT OF US LABEL ON CONSOLE



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Senographe 700T and 800T	Job Card IST 009	1 of 6

Purpose: **SENOGRAPHE PRELIMINARY TESTING**	Version No.: 1 Date: Dec. 18, 1995
Time: x h xx min	Personnel: 1

SECTION 1
SUPPLIES

None.

SECTION 2
TOOLS

- Digital mAs meter (Keithley type 35035) for equivalent able to display tube current.
- Kvp meter.
- Compression measurement tools: Mammo compression scale # 46–194427P407 (digital display).
- Plexiglass in thickness increments of 0.5 cm.

SECTION 3
SAFETY PRECAUTIONS

CAUTION

These procedures produce X–rays. Be sure to take appropriate precautions.

SECTION 4
PREREQUISITES

None.

SECTION 5
GENERATOR TESTING

The objective is to check quickly the generator kV, mA and mAs calibrations, which have already been done in the factory. At the same time, these procedures will warm up the X–ray tube slightly in preparation for the AEC calibration.

5.1 Set up generator for testing.

1. Turn OFF the Senographe.
2. Connect the digital mAs meter between terminals TP37 and TP39 of High Voltage Control Board 300PL8. (see illustration 1 of CAL 016) and remove jumper SK1 on same board.
3. Set the mAs meter to current (mA) measurement.
4. Turn ON the Senographe.
5. Activate display of parameters following an exposure by selecting **SETUP/INSTAL/CONFIG/DISP/YES** on the console (see Chapter 1, Section 3–10–3). Return to application mode in order to avoid to remove/replace cassette and move compression ar each exposure, select **SETUP/MEDICAL/1 –> 2/CASSETTE/CASSETTE DETECTION/NO.**
6. Configure the Senographe for the following exposure:
   - Manual (2–point) mode.
   - Focal spot: **LARGE** (18 x 24 collimator).
   - Filter: **MO**
   - 50 mAs
   - 22 kV

CAUTION

Protect the photocell with 4 cm of plexiglass.

7. Take 5 exposures at approximately 20 second intervals, incrementing the HV by 2 kV each time (i.e. 22 – 24 – 26 – 28 – 30 kV).
8. Take 5 more exposures at the same interval, leaving the HV set at 30 kV.
9. The X–ray tube current value displayed on the console ($I_{display}$) must be 100 mA ± 5 mA AND in agreement with the value read on the mAs meter ($I_{measure}$) ± 5%.

   IF $I_{display} = I_{measure}$ but ≠ 100 mA (e.g. 90 mA) then perform Job Card CAL 003 ”CALIBRATION OF X–RAY TUBE HEATER CURRENT”.

   IF $I_{display} \neq I_{measure}$ but $I_{display}$ = 100 mA then perform Job Card CAL 016 ”CALIBRATION OF X–RAY TUBE mA MEASUREMENT” followed by Job Card CAL 003 ”CALIBRATION OF X–RAY TUBE HEATER CURRENT”.
10. Take 2 exposures at 35 kV and 50 mAs at an interval of 30 seconds. No arcing should be detected. If arcing is detected, perform CAL 010 ”AUTOMATIC X–RAY TUBE WARM–UP”.

11. Re–configure the Senographe to 30 kV and 50 mAs. Take one exposure for each of the two following focal spot combinations and verify the expected X–ray tube current reading on the console display:

    SMALL FOCAL SPOT=> I = 30 mA ± 2 mA

    LARGE FOCAL SPOT => I = 100 mA ± 4 mA

Note: Changing focus is made by inserting proper collimator diaphragm into tube head.

12. Disconnect the mAs meter from the Senographe and re–connect the jumper on High Voltage Control Board 300PL8.
13. Verify kVp using a non–invasive kVp meter, and if needed, recalibrate kVp with CAL 017 (this step may be necessary, due to local regulation). Measurement conditions: use same configuration as in CAL 017 ”CALIBRATION OF kV SCALE FACTOR” 1. to 3. select 30 kV –50 mAs.

SECTION 6
GANTRY TESTING

The objective is to check quickly the basic functions of the gantry.

Note that the following functions are tested by the software during each power–up sequence:

- Filter holder rotation (for Senographe 800T only)

6.1 Check gantry readout (for Senographe 800T only)

Immediately following the power–up sequence, the gantry readout should indicate the compression pressure, the breast compressed thickness and the arm angulation.

6.2 Check column movement

1. With the compression paddle out of compression, check that all four column up/down control buttons are operational (check each button for up and down movement of column).
2. Move column to its upper and lower limits. Switches should stop movement. If switches sensors have failed, mechanical safety stops halt movement. Total one–way movement time (going either up or down) between upper and lower limits should be 15 ± 2 seconds. This time includes initial acceleration which lasts 3 seconds.

6.3 Check arm rotation.

1. With the compression paddle out of compression, check that all four arm rotation control buttons are operational (check each button for release electro brake).
2. Rotate arm through its full range of ± 180°. Check that electro–brake is sufficient by manual action on the handles.
3. Check alignment of angle markings at 0° (for Senographe 800T only)

SENOGRAPHE PRELIMINARY TESTING

Job Card IST 009

6.4 Check light centering device

1. Press one of the light centering device activation buttons. The light centering device should light for 30 seconds.

6.5 Check paddle compression

1. Verify that both sets of compression/decompression pedals (if this option is available) and the manual compression knobs located on the paddle holder all function correctly (i.e. the paddle goes up and down in response to each command).
2. Use the Mammo compression scale tool between the cassette holder and the compression paddle to check calibration of the compression force display on the readout. Measure one point at 5 daN and one point at 15 daN. The value on the readout must agree within ± 1 daN. If it does not, perform CAL 019 ”CALIBRATION OF COMPRESSION FORCE DETECTOR”.

6.6 Check breast thickness measurement (for Senographe 800T only)

1. Install the 18x24 bucky and place 10 mm of plexiglass on it.
2. Lower the compression paddle into contact with the plexiglass.
3. Slowly increase compression force on the plexiglass while watching the compression thickness display on the readout. The displayed value should remain in the range 10 mm ± 3 mm for any value of compression force (as displayed on the readout) between 5 and 15 kg.
4. Replace 10 mm of plexiglass with 50 mm of plexiglass and repeat the check above. Now the displayed value should remain in the range 50 mm ± 3 mm for any value of compression force (as displayed on the readout) between 5 and 15 kg.
5. If either or both of the above checks does not give a satisfactory result, perform Job Card CAL 009 ”CALIBRATION OF BREAST THICKNESS MEASUREMENT”.

6.7 Check magnification sensors (for Senographe 800T only)

Note: The readout doesn’t display the magnification factor, but it is possible to check if the Senographe detects the presence of the magnification stand, by reading the compression thickness value.

1. Install the magnification device into the position factor 1.5.
2. Lower the compression paddle into contact with the magnification device.
3. Slowly increase compression force on the magnification device while watching the compression thickness display on the readout. The displayed value should remain in the range 0 mm ± 3 mm for any value of compression force (as displayed on the readout) between 5 and 15 kg.
4. Reinstall the magnification device into the position 1.8 and repeat the check above.

SENOGRAPHE PRELIMINARY TESTING

Job Card IST 009

6.8 Check emergency stop buttons.

Pressing both of the emergency stop buttons (located on each side of the column) should result in a complete power–down of the Mammographe.

6.9 Check installation of HV.

Unscrew the vent screw to release pressure during long exposure unscrew of 3mm the vent screw of the HV block (see Ill1).

ILLUSTRATION 1

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Senographe 700T and 800T Job Card IST 010

Purpose: **SOFTWARE CONFIGURATION**	Version No.: Date: Dec. 18, 1995
Time: x h xx min	Personnel:

SECTION 1
SUPPLIES

None.

SECTION 2
TOOLS

None.

SECTION 3
SAFETY PRECAUTIONS

None.

SECTION 4
PREREQUISITES

None.

SECTION 5
SOFTWARE CONFIGURATION

The objective is to set correctly software configuration.

5.1 Medical Menu Configuration

1. Turn on the Senographe.
2. Choose console dialog display language:

   Starting from application mode, select **SETUP/MEDICAL/1/2/LANGUAGE/language** on the console, where *language* is the desired console dialog display language (FRANC, ENGL, DEUTS, ESPAN, ITALI, PORTU).

Note: For compatibility with the information contained in this manual concerning menu paths, select ENGL for installation of the Senographe. When installation is complete, you will have to change the language to that of the country of installation.

3. Set maximum decompression speed.

   Ask the doctor for the desired paddle compression speed (fast or slow). Starting from application mode, select **SETUP/MEDICAL/SPEED** on the console. Select FAST or SLOW on the console.

4. Set maximum compression force.

   Ask the doctor for the desired maximum compression force in daN.
   Select **SETUP/FORCE** on the console. Select + or – on the console repeatedly until the desired force value is reached (possible values range from 3 to 20 daN in steps of 1 daN). Once the desired value is reached, select VAL on the console to confirm the desired value.

5. Set automatic decompression.

   Ask the doctor if automatic decompression (e.g. return of the compression paddle to its home position) following an exposure is desired. Select **SETUP/DECOMP** on the console. Select YES on the console if automatic decompression is desired, or NO if it is not desired.

6. Set height decompression.

   Ask the doctor for the desired maximum height during automatic decompression (between 0 and 20 cm). Select **SETUP/HEIGHT** on the console. Select **+** or **–** on the console repeatedly until the desired height value is reached. Then select **VALID** to confirm the value.

7. Set cassette used.

   Select **SETUP/1/2/CASSETTE** ”Yes” have to be selected. The position ”No” allows to expose a film several times without removing a cassette from the bucky.

5.2 INSTALL/CONFIG Menu Configuration

1. Change the position of the installation menu enable switch (switch B1 on generator CPU board 300PL4, see ”Accessing the Generator or Gantry Installation Mode from the Console” in Chapter 1).
2. Starting from application mode, select :

   SETUP/INSTALL/CONFIG/DATE on the console.

   CRITERION: The time and date displayed on the console MUST correspond to the current time and date ±18 hours (to allow for differences in time zone between the factory location and the place of installation).

   If necessary, enter the connect date and hour as outlined in Section 3–10–4.

SOFTWARE CONFIGURATION

Job Card IST 010

3. Set the type of Senographe.

   Select **SETUP/TYPE**

   Enter ”700T for Senographe 700T and ”800T” for Senographe 800T.

Note: The generator output power (and maximum possible) value is 3.0 kW. It is not possible to modify it.

4. Set maximum of the generator mAs.

   Select **SETUP/CONFIG/MASMAX** on the console. Enter the maximum mAs value according to local regulations using the **NEXT** and **VALID** keys and rotating the kV dial. See sections 3–10–6 and 3–10–7 in Chapitre 1.

Note: The default (and maximum possible) value is +6.000E+2 (600) mAs.

5. Set maximum exposure time.

   Select **SETUP/T_MAX** on the console. Enter the maximum X–ray exposure time according to local regulations using the **NEXT** and **VALID** keys and rotating the kV dial. See sections 3–10–6 and 3–10–7 in Chapitre 1.

6. Perform a ”CHECKSUM”.

   Select **SETUP/SETUP/SETUP/CKSUM/CKSUM**

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Senographe 700T and 800T Job Card IST 011A

Purpose: **INSTALLATION FORM**	Version No.: 1 Date: April 4, 2001
Time: na	Personnel:

Note: **This procedure applies to the 700T/800T Senographes equiped with the "CAL007 6–parameter software", i.e., a software version lower or equal to V2.21.**

SECTION 1
PURPOSE

None.

SECTION 2
TOOLS

None.

SECTION 3
SPECIAL SAFETY PRECAUTIONS

None.

SECTION 4
PREREQUISITES

None.

SECTION 5
PROCEDURE

Use this form to note down all the data collected during the Senographe installation. This form has sufficient room for the calibration of 2 screen / film couples. You can also add your personnal notes and remarks at the end of this form, to help you during future maintenances.

Site Name	
System Number	
Installation Date	
Field Engineer	

INSTALLATION

INSTALLATION FORM

Job Card IST 011A

SECTION 6
GENERAL DATA: COLLECTED FOLLOWING STEERING GUIDE ORDER

TABLE 1
IST 004 – CONNECTION OF MAINS SUPPLY

Mains Supply – Nominal Value	200 / 208 / 220 / 230 / 240 VAC
Position of SK1	
Mains Supply: open circuit line voltage	

TABLE 2
IST 006 – CHECKING BASIC POWER SUPPLY VOLTAGES

	Name	Loaded
Measure for +5 VS	DC +5 VS	+5.2 to 5.25 VDC
Measure for +15 VS	DC +15 VS	+13.5 to +16.5VDC
Measure for –15 VS	DC –15 VS	–13.5 to –16.5VDC
Measure for (gantry) for 30 V	DC +30 Volts	
Measure for +5 VCC (ou CPU)	DC +5 Volts	

TABLE 3
CAL 011– SETTING OF ELEVATOR UPPER TRAVEL LIMIT

Ceiling height			
Switch setting	Up	Middle	Down

TABLE 4
IST 010 – SOFTWARE CONFIGURATION (MEDICAL)

Max comp speed	Fast	Slow
Max comp force	daN	
Auto decomp	Yes	No
Height decomp	mm	
Cassette detection	Yes	No

TABLE 5
IST 010 – SOFTWARE CONFIGURATION (CONFIG)

CONFIGURATION	700T	800T
max mAs		
max txp time		

INSTALLATION FORM

TABLE 6
IST 009 – GANTRY TEST

		DISPLAYED / MEASUREMENT VALUE
Compression force	5 daN	
	15 daN	
Compression thickness	10 mm	
	50 mm	

TABLE 7
IST 009 – GENERATOR TESTING

	DISPLAY OF CONSOLE	mAs METER
LF SF	mA mA	mA mA
at 30 kV / 50 mAs kVp test at 30 kV: kVp Meter display	kVp	

TABLE 8
CAL 006 – FILM / SCREEN COUPLE NAMES

	NAME	VALID	FILM USED	SCREEN USED (Y/N)
FSC = A				
FSC = B				
FSC = C				
FSC = D				
FSC = E				

INSTALLATION

SECTION 7
AEC / AOP DATA: FIRST FILM / SCREEN COUPLE

TABLE 9
CAL 013 – FIRST FILM – CALIBRATION OF FILM RECIPROCITY

FILM		
FSC =	NAME =	OD_REF =

TABLE 10
CAL 012 – FIRST FILM – SENSITOMETRY

FILM TYPE:					
STEPS	**OPTICAL D.**	**STEPS**	**OPTICAL D.**	**STEPS**	**OPTICAL D.**
1		8		15	
2		9		16	
3		10		17	
4		11		18	
5		12		19	
6		13		20	
7		14		21	

Estimated Gamma $\frac{\text{(Density (N+2) – density (N))}}{0.3} =$

TABLE 11
CAL 007 – FIRST FILM – TEST OF THICKNESS DISPLAYED ON THE CONSOLE

PLEXIGLASS THICKNESS >>	2 cm		4 cm		6 cm	
FILTER >>	MO	RH	MO	RH	MO	RH
Large focus / with grid / without screen						
Large focus / with grid / with screen						
Large focus / without grid / without screen / mag						
Large focus / without grid / with screen /mag						

INSTALLATION FORM

TABLE 12
CAL 013 – FIRST FILM – SENSITOMETRY TEST (NET OPTICAL DENSITY)

STEPS	3	5	7	9	11	13	15
Optical Density							

TABLE 13
CAL 013 – FIRST FILM – REFERENCE ENERGY

	mAs	OPTICAL DENSITY
exposure 1		
exposure 2		
exposure 3		

INSTALLATION FORM

Job Card IST 011A

TABLE 14
CAL 013 – FIRST FILM – CALIBRATION OF LNRT PARAMETERS

	THICKNESS OF PLEXI (cm)	OPTICAL DENSITY
exposure 1		
exposure 2		
exposure 3		
exposure 4		
exposure 5		
exposure 6		
exposure 7		
exposure 8		
exposure 9		
exposure 10		
exposure 11		
exposure 12		
exposure 13		
exposure 14		
exposure 15		
exposure 16		
Final LNRT parameters	A 0 =	+ . E –
	A 1 =	+ . E –
	A 2 =	+ . E –

Gamma calculated by Senographe	Reference energy
Gamma =	+ E +

Default parameters:

A 0 = +1.890E–1
A 1 = +5.968E–1
A 2 = +2.225E–2

INSTALLATION FORM

TABLE 15
CAL 013 – FIRST FILM – AEC TESTING (TRACK Mo AND FILTER Mo)

KV / PLEXIGLASS THICKNESS	MEASURED THICKNESS	mAs	TIME	OPTICAL DENSITY	O.D. DIFFERENCE FROM 28 / 4 cm
28 / 4 cm					
32 / 1.5 cm					
28 / 5.5 cm					

TABLE 16
CAL 014 – FIRST FILM – CALIBRATION OF REFERENCE ENERGY

OD. R =	D. STEP =

TABLE 17
CAL 014 – FIRST FILM – SENSITOMETRY TEST (NET OPTICAL DENSITY)

STEPS	3	5	7	9	11	13	15
Optical Density							

TABLE 18
CAL 014 – FIRST FILM – REFERENCE ENERGY

Final LNRT parameters	A 0 =	+ . E –
	A 1 =	+ . E –
	A 2 =	+ . E –

	mAs	OPTICAL DENSITY
exposure 1		
exposure 2		
exposure 3		
Final LNRT parameters	A 0 =	+ . E –
	A 1 =	+ . E –
	A 2 =	+ . E –

INSTALLATION FORM

Job Card IST 011A

Gamma calculated by Senographe	Reference energy
Gamma =	

Default parameters:

Gamma = 3.033 E + 0
Energy = 2.522 E + 5

INSTALLATION FORM

Job Card IST 011A

TABLE 19
CAL 014 – FIRST FILM – AEC TESTING (TRACK Mo AND FILTER Mo)

KV / PLEXIGLASS	MEASURED THICKNESS	mAs	TIME	OPTICAL DENSITY	O.D. DIFFERENCE FROM 28 / 4 cm
28 / 4 cm					
28 / 2cm					
28 / 6 cm					
26 / 4 cm					
32 / 4 cm					

TABLE 20
CAL 022 – FIRST FILM – MANUAL STRATEGY DETERMINATION

AOP strategy determined by the system	Very Slow / Slow / Medium / Fast / Very Fast / Super Fast
AOP strategy retained for the system (multi–rooms only !)	Very Slow / Slow / Medium / Fast / Very Fast / Super Fast

INSTALLATION

INSTALLATION FORM

Job Card IST 011A

SECTION 8
AEC / AOP DATA: SECOND FILM / SCREEN COUPLE

TABLE 21
CAL 013 – SECOND FILM – CALIBRATION OF FILM RECIPROCITY

FILM		
FSC =	NAME =	OD_REF =

TABLE 22
CAL 012 – SECOND FILM – SENSITOMETRY

FILM TYPE:					
STEPS	**OPTICAL D.**	**STEPS**	**OPTICAL D.**	**STEPS**	**OPTICAL D.**
1		8		15	
2		9		16	
3		10		17	
4		11		18	
5		12		19	
6		13		20	
7		14		21	

$$\text{Estimated Gamma} \quad \frac{(\text{Density }(N+2) - \text{density }(N))}{0.3} =$$

TABLE 23
CAL 007 – SECOND FILM – TEST OF THICKNESS DISPLAYED ON THE CONSOLE

PLEXIGLASS THICKNESS >>	**2 cm**		**4 cm**		**6 cm**	
FILTER >>	**MO**	**RH**	**MO**	**RH**	**MO**	**RH**
Large focus / with grid / without screen						
Large focus / with grid / with screen						
Small focus / without grid / without screen						
Small focus / without grid / with screen						

INSTALLATION FORM

Job Card IST 011A

TABLE 24
CAL 013 – SECOND FILM – SENSITOMETRY TEST (NET OPTICAL DENSITY)

STEPS	3	5	7	9	11	13	15
Optical Density							

TABLE 25
CAL 013 – SECOND FILM – REFERENCE ENERGY

	mAs	OPTICAL DENSITY
exposure 1		
exposure 2		
exposure 3		

INSTALLATION FORM

Job Card IST 011A

TABLE 26
CAL 013 – SECOND FILM – CALIBRATION OF LNRT PARAMETERS

	THICKNESS OF PLEXI (cm)	OPTICAL DENSITY
exposure 1		
exposure 2		
exposure 3		
exposure 4		
exposure 5		
exposure 6		
exposure 7		
exposure 8		
exposure 9		
exposure 10		
exposure 11		
exposure 12		
exposure 13		
exposure 14		
exposure 15		
exposure 16		
Final LNRT parameters	A 0 =	+ . E –
	A 1 =	+ . E –
	A 2 =	+ . E –

Gamma calculated by Senographe	Reference energy
Gamma =	+ E +

Default parameters:

A 0 = +1.890E–1
A 1 = +5.968E–1
A 2 = +2.225E–2

INSTALLATION FORM

Job Card IST 011A

TABLE 27
CAL 013 – SECOND FILM – AEC TESTING (TRACK Mo AND FILTER Mo)

KV / PLEXIGLASS THICKNESS	MEASURED THICKNESS	mAs	TIME	OPTICAL DENSITY	O.D. DIFFERENCE FROM 28 / 4 cm
28 / 4 cm					
32 / 1.5 cm					
28 / 5.5 cm					

TABLE 28
CAL 014 – SECOND FILM – CALIBRATION OF REFERENCE ENERGY

OD. R =	D. STEP =

TABLE 29
CAL 014 – SECOND FILM – SENSITOMETRY TEST (NET OPTICAL DENSITY)

STEPS	3	5	7	9	11	13	15
Optical Density							

TABLE 30
CAL 014 – SECOND FILM – REFERENCE ENERGY

	mAs	OPTICAL DENSITY
exposure 1		
exposure 2		
exposure 3		

Gamma calculated by Senographe	Reference energy
Gamma =	

Default parameters:

Gamma = 3.033 E + 0
Energy = 2.522 E + 5

INSTALLATION FORM

Job Card IST 011A

TABLE 31
CAL 014 – SECOND FILM – AEC TESTING (TRACK Mo AND FILTER Mo)

KV / PLEXIGLASS	MEASURED THICKNESS	mAs	TIME	OPTICAL DENSITY	O.D. DIFFERENCE FROM 28 / 4 cm
28 / 4 cm					
28 / 2cm					
28 / 6 cm					
26 / 4 cm					
32 / 4 cm					

TABLE 32
CAL 022 – SECOND FILM – MANUAL STRATEGY DETERMINATION

AOP strategy determined by the system	Very Slow / Slow / Medium / Fast / Very Fast / Super Fast
AOP strategy retained for the system (multi–rooms only !)	Very Slow / Slow / Medium / Fast / Very Fast / Super Fast

Senographe 700T and 800T Job Card IST 011B

Purpose: **INSTALLATION FORM**	Version No.: 1 Date: March 14, 2001
Time: na	Personnel:

Note: **This procedure applies to the 700T/800T Senographes equiped with the "CAL007 9–parameter software", i.e., a software version higher or equal to V2.31.**

SECTION 1
PURPOSE

None.

SECTION 2
TOOLS

None.

SECTION 3
SPECIAL SAFETY PRECAUTIONS

None.

SECTION 4
PREREQUISITES

None.

SECTION 5
PROCEDURE

Use this form to note down all the data collected during the Senographe installation. This form has sufficient room for the calibration of 2 screen / film couples. You can also add your personnal notes and remarks at the end of this form, to help you during future maintenances.

Site Name	
System Number	
Installation Date	
Field Engineer	

INSTALLATION FORM

Job Card IST 011B

SECTION 6
GENERAL DATA: COLLECTED FOLLOWING STEERING GUIDE ORDER

TABLE 1
IST 004 – CONNECTION OF MAINS SUPPLY

Mains Supply – Nominal Value	200 / 208 / 220 / 230 / 240 VAC
Position of SK1	
Mains Supply: open circuit line voltage	

TABLE 2
IST 006 – CHECKING BASIC POWER SUPPLY VOLTAGES

	Name	Loaded
Measure for +5 VS	DC +5 VS	+5.2 to 5.25 VDC
Measure for +15 VS	DC +15 VS	+13.5 to +16.5VDC
Measure for –15 VS	DC –15 VS	–13.5 to –16.5VDC
Measure for (gantry) for 30 V	DC +30 Volts	
Measure for +5 VCC (ou CPU)	DC +5 Volts	

TABLE 3
CAL 011– SETTING OF ELEVATOR UPPER TRAVEL LIMIT

Ceiling height			
Switch setting	Up	Middle	Down

TABLE 4
IST 010 – SOFTWARE CONFIGURATION (MEDICAL)

Max comp speed	Fast	Slow
Max comp force	daN	
Auto decomp	Yes	No
Height decomp	mm	
Cassette detection	Yes	No

TABLE 5
IST 010 – SOFTWARE CONFIGURATION (CONFIG)

CONFIGURATION	700T	800T
max mAs		
max txp time		

INSTALLATION FORM

Job Card IST 011B

TABLE 6
IST 009 – GANTRY TEST

		DISPLAYED / MEASUREMENT VALUE
Compression force	5 daN	
	15 daN	
Compression thickness	10 mm	
	50 mm	

TABLE 7
IST 009 – GENERATOR TESTING

	DISPLAY OF CONSOLE	mAs METER
LF SF	mA mA	mA mA
at 30 kV / 50 mAs kVp test at 30 kV: kVp Meter display	kVp	

TABLE 8
CAL 006 – FILM / SCREEN COUPLE NAMES

	NAME	VALID	FILM USED	SCREEN USED (Y/N)
FSC = A				
FSC = B				
FSC = C				
FSC = D				
FSC = E				

INSTALLATION FORM

Job Card IST 011B

SECTION 7
AEC / AOP DATA: FIRST FILM / SCREEN COUPLE

TABLE 9
CAL 013B – FIRST FILM – CALIBRATION OF FILM RECIPROCITY

FILM		
FSC =	NAME =	OD_REF =

TABLE 10
CAL 012 – FIRST FILM – SENSITOMETRY

FILM TYPE:					
STEPS	**OPTICAL D.**	**STEPS**	**OPTICAL D.**	**STEPS**	**OPTICAL D.**
1		8		15	
2		9		16	
3		10		17	
4		11		18	
5		12		19	
6		13		20	
7		14		21	

Estimated Gamma $\dfrac{\text{(Density (N+2) – density (N))}}{0.3} =$

TABLE 11
CAL 007B – FIRST FILM – TEST OF THICKNESS DISPLAYED ON THE CONSOLE

PLEXIGLASS THICKNESS >>	**1 cm / 29 kV**		**4 cm / 25 kV**		**4 cm / 29 kV**		**4 cm / 34 kV**		**7 cm / 29 kV**	
FILTER >>	**MO**	**RH**	**MO**	**RH**	**MO**	**RH**	**MO**	**RH**	**MO**	**RH**
Contact Mode / with grid / without screen										
Contact Mode / with grid / with screen										
Mag. Mode / without grid / without screen										
Mag. Mode / without grid / with screen										

INSTALLATION FORM

TABLE 12
CAL 013B – FIRST FILM – SENSITOMETRY TEST (NET OPTICAL DENSITY)

STEPS	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Net Optical Density							
STEPS	**8**	**9**	**10**	**11**	**12**	**13**	**14**
Net Optical Density							
STEPS	**15**	**16**	**17**	**18**	**19**	**20**	**21**
Net Optical Density							

TABLE 13
CAL 013B – FIRST FILM – REFERENCE ENERGY

	mAs	**OPTICAL DENSITY**
exposure 1		
exposure 2		
exposure 3		

TABLE 14
CAL 013B – FIRST FILM – CALIBRATION OF LNRT PARAMETERS

	THICKNESS OF PLEXI (cm)	OPTICAL DENSITY
exposure 1		
exposure 2		
exposure 3		
exposure 4		
exposure 5		
exposure 6		
exposure 7		
exposure 8		
exposure 9		
exposure 10		
exposure 11		
exposure 12		
exposure 13		
exposure 14		
exposure 15		
exposure 16		
Final LNRT parameters	A 0 =	+ . E –
	A 1 =	+ . E –
	A 2 =	+ . E –

Gamma Model Parameters				
D–BF	D–MAX	A–SENS	B–SENS	Sigma
Reference Energy			+ . E +	

Default parameters:

A 0 = +1.867E–1 A 1 = +4.628E–1 A 2 = +1.821E–1

Reference Energy = 2.522 E + 5

D–BF = –1.000E–7 D–MAX = +5.730E+0 A–SENS = –9.119E+0 B–SENS = 6.778E–1

SIGMA = 1.000E+0

TABLE 15
CAL 013B – FIRST FILM – AEC TESTING (TRACK Mo AND FILTER Mo)

KV / PLEXIGLASS THICKNESS	MEASURED THICKNESS	mAs	TIME	OPTICAL DENSITY	O.D. DIFFERENCE FROM 28 / 4 cm
28 / 4 cm					
32 / 1.5 cm					
28 / 5.5 cm					

TABLE 16
CAL 014B – FIRST FILM – CALIBRATION OF REFERENCE ENERGY

OD. R =	D. STEP =

TABLE 17
CAL 014B – FIRST FILM – SENSITOMETRY TEST (NET OPTICAL DENSITY)

STEPS	1	2	3	4	5	6	7
Net Optical Density							
STEPS	**8**	**9**	**10**	**11**	**12**	**13**	**14**
Net Optical Density							
STEPS	**15**	**16**	**17**	**18**	**19**	**20**	**21**
Net Optical Density							

INSTALLATION

INSTALLATION FORM

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TABLE 18
CAL 014B – FIRST FILM – REFERENCE ENERGY

LNRT parameters	A 0 =	+ . E –
	A 1 =	+ . E –
	A 2 =	+ . E –

	mAs	**OPTICAL DENSITY**
exposure 1		
exposure 2		
exposure 3		

Gamma Model Parameters				
D–BF	D–MAX	A–SENS	B–SENS	Sigma
Reference Energy			+ . E +	

Default parameters:

A 0 = +1.867E–1 A 1 = +4.628E–1 A 2 = +1.821E–1

Reference Energy = 2.522 E + 5

D–BF = –1.000E–7 D–MAX = +5.730E+0 A–SENS = –9.119E+0 B–SENS = 6.778E–1

SIGMA = 1.000E+0

INSTALLATION FORM

Job Card IST 011B

TABLE 19
CAL 014B – FIRST FILM – AEC TESTING (TRACK Mo AND FILTER Mo)

KV / PLEXIGLASS	MEASURED THICKNESS	mAs	TIME	OPTICAL DENSITY	O.D. DIFFERENCE FROM 28 / 4 cm
28 / 4 cm					
32 / 1.5cm					
28 / 5.5 cm					

TABLE 20
CAL 022 – FIRST FILM – MANUAL STRATEGY DETERMINATION

AOP strategy determined by the system	Very Slow / Slow / Medium / Fast / Very Fast / Super Fast
AOP strategy retained for the system (multi–rooms only !)	Very Slow / Slow / Medium / Fast / Very Fast / Super Fast

INSTALLATION

INSTALLATION FORM Job Card IST 011B

SECTION 8
AEC / AOP DATA: SECOND FILM / SCREEN COUPLE

TABLE 21
CAL 013B – SECOND FILM – CALIBRATION OF FILM RECIPROCITY

FILM		
FSC =	NAME =	OD_REF =

TABLE 22
CAL 012 – SECOND FILM – SENSITOMETRY

FILM TYPE:					
STEPS	**OPTICAL D.**	**STEPS**	**OPTICAL D.**	**STEPS**	**OPTICAL D.**
1		8		15	
2		9		16	
3		10		17	
4		11		18	
5		12		19	
6		13		20	
7		14		21	

$$\text{Estimated Gamma} \quad \frac{(\text{Density (N+2)} - \text{density (N)})}{0.3} =$$

TABLE 23
CAL 007B – SECOND FILM – TEST OF THICKNESS DISPLAYED ON THE CONSOLE

PLEXIGLASS THICKNESS >>	**1 cm / 29 kV**		**4 cm / 25 kV**		**4 cm / 29 kV**		**4 cm / 34 kV**		**7 cm / 29 kV**	
FILTER >>	**MO**	**RH**	**MO**	**RH**	**MO**	**RH**	**MO**	**RH**	**MO**	**RH**
Contact Mode / with grid / without screen										
Contact Mode / with grid / with screen										
Mag. Mode / without grid / without screen										
Mag. Mode / without grid / with screen										

INSTALLATION FORM

Job Card IST 011B

TABLE 24
CAL 013B – SECOND FILM – SENSITOMETRY TEST (NET OPTICAL DENSITY)

STEPS	1	2	3	4	5	6	7
Net Optical Density							
STEPS	**8**	**9**	**10**	**11**	**12**	**13**	**14**
Net Optical Density							
STEPS	**15**	**16**	**17**	**18**	**19**	**20**	**21**
Net Optical Density							

TABLE 25
CAL 013B – SECOND FILM – REFERENCE ENERGY

	mAs	OPTICAL DENSITY
exposure 1		
exposure 2		
exposure 3		

INSTALLATION

INSTALLATION FORM

TABLE 26
CAL 013B – SECOND FILM – CALIBRATION OF LNRT PARAMETERS

	THICKNESS OF PLEXI (cm)	OPTICAL DENSITY
exposure 1		
exposure 2		
exposure 3		
exposure 4		
exposure 5		
exposure 6		
exposure 7		
exposure 8		
exposure 9		
exposure 10		
exposure 11		
exposure 12		
exposure 13		
exposure 14		
exposure 15		
exposure 16		
Final LNRT parameters	A 0 =	+ . E –
	A 1 =	+ . E –
	A 2 =	+ . E –

Gamma Model Parameters				
D–BF	D–MAX	A–SENS	B–SENS	Sigma
Reference Energy			+ . E +	

INSTALLATION FORM

Job Card IST 011B

Default parameters:

A 0 = +1.867E–1 A 1 = +4.628E–1 A 2 = +1.821E–1

Reference Energy = 2.522 E + 5

D–BF = –1.000E–7 D–MAX = +5.730E+0 A–SENS = –9.119E+0 B–SENS = 6.778E–1

SIGMA = 1.000E+0

TABLE 27
CAL 013B – SECOND FILM – AEC TESTING (TRACK Mo AND FILTER Mo)

KV / PLEXIGLASS THICKNESS	MEASURED THICKNESS	mAs	TIME	OPTICAL DENSITY	O.D. DIFFERENCE FROM 28 / 4 cm
28 / 4 cm					
32 / 1.5 cm					
28 / 5.5 cm					

TABLE 28
CAL 014B – SECOND FILM – CALIBRATION OF REFERENCE ENERGY

OD. R =	D. STEP =

TABLE 29
CAL 014B – SECOND FILM – SENSITOMETRY TEST (NET OPTICAL DENSITY)

STEPS	1	2	3	4	5	6	7
Net Optical Density							
STEPS	**8**	**9**	**10**	**11**	**12**	**13**	**14**
Net Optical Density							
STEPS	**15**	**16**	**17**	**18**	**19**	**20**	**21**
Net Optical Density							

TABLE 30
CAL 014B – SECOND FILM – REFERENCE ENERGY

LNRT parameters	A 0 =	+ . E –
	A 1 =	+ . E –
	A 2 =	+ . E –

INSTALLATION

INSTALLATION FORM

Job Card IST 011B

	mAs	OPTICAL DENSITY
exposure 1		
exposure 2		
exposure 3		

Gamma Model Parameters				
D–BF	D–MAX	A–SENS	B–SENS	Sigma
Reference Energy		+ . E +		

Default parameters:

A 0 = +1.867E–1 A 1 = +4.628E–1 A 2 = +1.821E–1

Reference Energy = 2.522 E + 5

D–BF = –1.000E–7 D–MAX = +5.730E+0 A–SENS = –9.119E+0 B–SENS = 6.778E–1

SIGMA = 1.000E+0

TABLE 31
CAL 014B – SECOND FILM – AEC TESTING (TRACK Mo AND FILTER Mo)

KV / PLEXIGLASS	MEASURED THICKNESS	mAs	TIME	OPTICAL DENSITY	O.D. DIFFERENCE FROM 28 / 4 cm
28 / 4 cm					
32 / 1.5 cm					
28 / 5.5 cm					

TABLE 32
CAL 022 – SECOND FILM – MANUAL STRATEGY DETERMINATION

AOP strategy determined by the system	Very Slow / Slow / Medium / Fast / Very Fast / Super Fast
AOP strategy retained for the system (multi–rooms only !)	Very Slow / Slow / Medium / Fast / Very Fast / Super Fast

CHAPTER 2 – CENTRAL LISTING

100PL2 CONSOLE CONTROL BOARD 2106486 SCH Rev 1

NUMBER	COLOR	SCHEMATICS LOCATION	DESCRIPTION
DS1		2/4–4B	VCC

200PL1 ARM1 DISTRIBUTION BOARD 2111929 SCH Rev 1

NUMBER	SCHEMATICS LOCATION	SIGNAL TYPE	TYPICAL VALUE OR RANGE	DESCRIPTION
TP1	1/1–3/F	DC	0 V	GND

NUMBER	COLOR	SCHEMATICS LOCATION	DESCRIPTION
DS1	GREEN	1/1–3/C	
DS2	GREEN	1/1–3/D	

200PL3 BUCKY COMMAND BOARD 2111937 SCH Rev 1

NUMBER	COLOR	SCHEMATICS LOCATION	DESCRIPTION
DS1	GREEN	4/4–7/C	–15VF
DS2	RED	3/4–10/C	
DS3	RED	3/4–9/C	
DS4	RED	3/4–10/C	
DS5	GREEN	1/4–4/B	Reset

JUMPER	STATUS	DESCRIPTION
U14	Opened	Application Mode
U14	Closed	Test Mode

CENTRAL LISTING

CHART 1

	DS2	DS3	DS4	BUCKY_FAIL
INIT	1	1	1	0
Edge detection failure	0	1	1	1
Travel failure	1	0	1	1
Step loss failure	1	1	0	1
Left centering index failure	0	0	1	1
Right centering index failure	1	0	0	1

For DS2, DS3 and DS4 “0” is when the diode is lit.

200PL3 BUCKY COMMAND BOARD 2111937 SCH Rev 1

NUMBER	SCHEMATICS LOCATION	SIGNAL TYPE	TYPICAL VALUE OR RANGE	DESCRIPTION
TP1	4/4–8/B	DC	0 V	0 V
TP2	4/4–9/A	DC	+30V	+30V_STATIF
TP3	2/4–11/E	DC		I_PHASE2
TP4	2/4–11/A	DC		I_PHASE1
TP5	2/4–11/C	DC		PHASE_I+
TP6	2/4–11/F	DC		PHASE_2+
TP7	4/4–8/A	DC	+15V	+15VF
TP8	4/4–8/B	DC	– 15V	– 15 V
TP9	4/4–9/B	DC	5 V	VCC
TP10	2/4–2/B	DC		REF1
TP11	2/4–2/E	DC		REF2

200PL4 DISPLAY BOARD 2127247–2 SCH Rev 1

NUMBER	SCHEMATICS LOCATION	SIGNAL TYPE	TYPICAL VALUE OR RANGE	DESCRIPTION
TP1	1/2–7/F	DC	0 V	GROUND

200PL5 HVPM BOARD 2111931 SCH Rev B

NUMBER	SCHEMATICS LOCATION	SIGNAL TYPE	TYPICAL VALUE OR RANGE	DESCRIPTION
TP1	1/1–11/B	DC	0 V	
TP2	1/1 –11/C	DC		
TP3	1/1–6/D	DC		

200PL7 COMPRESSION SENSOR BOARD 2111935–2 SCH RevA

NUMBER	SCHEMATICS LOCATION	SIGNAL TYPE	TYPICAL VALUE OR RANGE	DESCRIPTION
TP1	1/1– 10/B	DC	0 V	Ground

200PL9 ARM 2 DISTRIBUTION BOARD 2120924 SCH – Rev 1

NUMBER	COLOR	SCHEMATICS LOCATION	DESCRIPTION
DS1	GREEN	1/2–1/A	
DS2	RED	1/2–7/D	

NUMBER	SCHEMATICS LOCATION	SIGNAL TYPE	TYPICAL VALUE OR RANGE	DESCRIPTION
TP1	2/2–2/F	DC	0 V	GROUND
TP2	2/2–3/E	DC		ANGLE
TP3	2/2–3/C	DC		THICKNESS
TP4	1/2–7/F	DC	+30 V	+30 V_STATIF
TP5	2/2–9/B	DC	15 VF	ALIM
TP6	2/2–11/A	DC	5 V	VCC

300PL1 ELEVATOR & COMPRESSION BOARD 2147559 –SCH Rev 1

NUMBER	SCHEMATICS LOCATION	SIGNAL TYPE	TYPICAL VALUE OR RANGE	DESCRIPTION
TP1	5/8–6/G	DC		PWM_1
TP2	5/8–3/G	DC		PWM_2
TP3	6/8–4/B	DC		
TP4	6/8–3/C	DC		
TP5	6/8–4/C	DC		
TP6	6/8–6/C	DC		
TP7	6/8–7/B	DC		
TP8	6/8–7/B	DC		
TP9	8/8–7/F	DC	+5 V	5 V
TP10	8/10–6/F	DC	+ 15 V	+ 15V
TP11	7/8–7/G	DC		
TP12	7/8–6/G	DC		
TP13	7/8–4/G	DC		
TP14	7/8–3/G	DC		
TP15	4/8–8/H	DC		ELEV –
TP16				
TP17	4/8–6/H	DC		ELEV +
TP18	8/8–6/F	DC	+15 V	+ 15 V
TP19	2/8–8/D	DC		
TP20				
TP21	2/8–3/G	DC		VEROUA
TP22	1/8–3/E	DC		PWM_1
TP23	1/8–2/E	DC		PWM_2
TP24	1/8_1/E	DC		PWM
TP25	2/8–6/E	DC		I_SENSE
TP26	5/8–5/E	DC		_SENSE_1
TP27	5/8–2/E	DC		_SENSE_2
TP28	2/8–5/G	DC		VEROUB

CIRCUIT BRKR/FUSE	RATING	NOMINAL VOLTAGE	DESCRIPTION
F1	0.32A–250 V FAST FUSE	30 V	30 V ALIM
F2	3A–250 V FAST FUSE	30 V	30 V COMP
F3	10A–250 V FAST FUSE	30 V	30 V ELEV

300PL2 LIGHT & ROTATION BOARD 2147558 – SCH Rev 1

NUMBER	SCHEMATICS LOCATION	SIGNAL TYPE	TYPICAL VALUE OR RANGE	DESCRIPTION
TP1	4/5–3/E	DC	+5 V	+5 VL
TP2	4/5–3/E	DC	+15 V	+15 V
TP3	4/5–3/D	DC	–15 V	–15 V
TP4	4/5–3/D	DC	+30 V	30 V ALIM

300PL2 LIGHT & ROTATION BOARD 2147558 – Rev 4

CIRCUIT BRKR/FUSE	RATING	NOMINAL VOLTAGE	DESCRIPTION
F1	8A–250 V FAST FUSE	30 V	ROT
F5	2A–250 V FAST FUSE	30 V	RELAY
F3	10A–250 V SLOW FUSE	30 V	LIGHT

NUMBER	COLOR	SCHEMATICS LOCATION	DESCRIPTION
DS1	RED	4/4–7/F	30 V ROTATION
DS2	RED	4/4–7/D	30 V LIGHT
DS3	RED	4/4–7/C	30 V RELAYAGE
DS4	GREEN	4/4–E/2	+5 VL
DS5	GREEN	4/4–E/2	+15 V
DS6	GREEN	4/4–E/2	–15 V
DS7	GREEN	4/4–D/2	30 V ALIM

CENTRAL LISTING

CENTRAL LISTING

300PL4 CPU BOARD 2101204–2 SCH Rev 1

NUMBER	COLOR	SCHEMATICS LOCATION	DESCRIPTION
DS1	GREEN	6/11–1/D	TEST_OK
DS2	YELLOW	6/11–1/G	TXT TLB1
DS3	YELLOW	6/11–1/F	RXDB1
DS4	YELLOW	6/11–1/F	TXTTLA1
DS5	YELLOW	6/11–1/F	RXDA1
DS6	YELLOW	6/11–1/E	TXTTLA2
DS7	YELLOW	6/11–1/E	RXDA2
DS8	YELLOW	6/11–1/D	TXTTLB2
DS9	YELLOW	6/11–1/D	RXDB2
DS10	RED	9/11–4/E	HALT
DS11	RED	9/11–4/E	RESET

300PL4 CPU BOARD 2101204–2 SCH Rev 1

NUMBER	SCHEMATICS LOCATION	SIGNAL TYPE	TYPICAL VALUE OR RANGE	DESCRIPTION
TP1	9/11–1/G	DC	0 V	PLOT
TP2	10/11–3/D	DC		_LSD
TP3	10/11–3/D	DC		_CS_DUART
TP4	10/11–3/D	DC		_USD
TP5	10/11–3/C	DC		_IRQ_DUART2
TP6	10/11–3/C	DC		_IRQ_DUART1
TP7	10/11–1/E	DC		664_2
TP8	10/11–1/D	DC		664_2
TP9	10/11–3/H	DC		ADDR19
TP10	10/11–3/H	DC		ADDR18
TP11	10/11–3/H	DC		ADDR17
TP12	10/11–3/H	DC		ADDR16
TP13	10/11–3/D	DC		

300PL4 CPU BOARD 2101204–2 SCH Rev 1

NUMBER	SCHEMATICS LOCATION	SIGNAL TYPE	TYPICAL VALUE OR RANGE	DESCRIPTION
TP14	10/11–3/H	DC		GND
TP15	10/11–3/H	DC		GND
TP16	10/11–3/H	DC		VCC
TP17	10/11–3/H	DC		VCC
TP18	10/11–4/D	DC		CTRL_MEM1
TP19	10/11–4/D	DC		CTRL_MEM0
TP20	10/11–4/H	DC		ADDR20
TP21	10/11–4/D	DC		CTRL_MEM3
TP22	10/11–4/D	DC		CTRL_MEM2
TP23	10/11–2/D	DC		_CS_DATEUR
TP24	10/11–4/H	DC		ADDR21
TP25	10/11–4/H	DC		ADDR22
TP26	10/11–4/H	DC		ADDR23
TP27	10/11–1/H	DC		SYMCH8
TP28	10/11–2/H	DC		SYMCH7
TP29	10/11–2/A	DC		SYMCH1
TP30	10/11–1/H	DC		SYMCH6
TP31	10/11–1/D	DC		EC2
TP32	10/11–1/D	DC		EC1
TP33	10/11–3/A	DC		
TP34	10/11–3/A	DC		
TP35	10/11–1/D	DC		
TP36	10/11–3/A	DC		
TP37	10/11–4/A	DC		_DTACK
TP38	10/11–3/D	DC		IRQ_696

300PL4 CPU BOARD 2101204–2 SCH Rev 1

NUMBER	SCHEMATICS LOCATION	SIGNAL TYPE	TYPICAL VALUE OR RANGE	DESCRIPTION
TP39	10/11–3/C	DC		664_10
TP40	10/11–3/C	DC		SYMCH11
TP41	10/11–1/H	DC		SYNCH2
TP42	10/11–3/C	DC		NMI_664
TP43	10/11–3/C	DC		IRQ_664
TP44				
TP45	8/11–3/C	DC		FC2
TP46	8/11–3/C	DC		FC0
TP47	8/11–3/C	DC		FC1
TP48	8/11–2/C	DC		ADDR1
TP49	8/11–2/C	DC		ADDR3
TP50	8/11–2/C	DC		ADDR2
TP51	8/11–2/C	DC		ADDR5
TP52	8/11–2/C	DC		ADDR4
TP53	8/11–2/C	DC		ADDR6
TP54	8/11–2/C	DC		ADDR7
TP55	8/11–2/C	DC		ADDR8
TP56	8/11–2/C	DC		ADDR9
TP57	8/11–2/C	DC		ADDR10
TP58	8/11–2/C	DC		ADDR11
TP59	8/11–3/C	DC		ADDR12
TP60	8/11–3/C	DC		ADDR13
TP61	8/11–3/C	DC		ADDR16
TP62	8/11–3/C	DC		ADDR15
TP63	8/11–3/C	DC		ADDR18
TP64	8/11–3/C	DC		ADDR17

300PL4 CPU BOARD 2101204–2 SCH Rev 1

NUMBER	SCHEMATICS LOCATION	SIGNAL TYPE	TYPICAL VALUE OR RANGE	DESCRIPTION
TP65	8/11–3/C	DC		ADDR19
TP66	8/11–3/C	DC		ADDR20
TP67	8/11–3/C	DC		ADDR21
TP68	8/11–3/C	DC		ADDR22
TP69	8/11–3/C	DC		ADDR23
TP70	8/11–3/E	DC		DATA15
TP71	8/11–3/E	DC		DATA14
TP72	8/11–3/E	DC		DATA13
TP73	8/11–3/E	DC		DATA11
TP74	8/11–3/E	DC		DATA12
TP75	8/11–3/E	DC		DATA9
TP76	8/11–3/E	DC		DATA10
TP77	8/11–3/E	DC		DATA7
TP78	8/11–3/E	DC		DATA8
TP79	8/11–2/E	DC		DATA5
TP80	8/11–2/E	DC		DATA6
TP81	8/11–2/E	DC		DATA3
TP82	8/11–2/E	DC		DATA4
TP83	8/11–2/E	DC		DATA2
TP84	8/11–2/E	DC		DATA1
TP85	8/11–2/E	DC		DATA0
TP86	8/11–4/C	DC		AS
TP87	8/11–4/C	DC		USD
TP88	8/11–4/C	DC		LSD
TP89	8/11–4/C	DC		RW
TP90	8/11–3/D	DC		

300PL4 CPU BOARD 2101204–2 SCH Rev 1

NUMBER	SCHEMATICS LOCATION	SIGNAL TYPE	TYPICAL VALUE OR RANGE	DESCRIPTION
TP91	8/11–4/E	DC		DTACK
TP92	8/11–4/D	DC		
TP93	8/11–3/D	DC		
TP94	8/11–2/E	DC		CLK8MHZ
TP95	8/11–2/D	DC		_HALT
TP96	8/11–4/B	DC		VMA_CPU
TP97	8/11–2/D	DC		_RESET
TP98	8/11–3/E	DC		7PA_CPU
TP99	8/11–4/C	DC		E
TP100	8/11–2/D	DC		_BERR
TP101	8/11–2/D	DC		IPL2
TP102	8/11–2/D	DC		IPL1
TP103	8/11–3/C	DC		ADDR14
TP104	8/11–1/G	DC	0 V	GROUND
TP105	8/11–1/G	DC	0 V	GROUND
TP106	8/11–1/G	DC	0 V	GROUND
TP107	8/11–1/G	DC		VCC
TP108	8/11–1/G	DC		VCC
TP109	8/11–1/G	DC		VCC
TP110	9/11–2D	DC		VCC
TP111	9/11–2D	DC	0 V	GRND
TP112	9/11–2D	DC	+5 V	ALIM_SAUV_+5 V

300PL5 GENERATOR AND ARM INTERFACE BOARD 2111941–3 SCH Rev 1

NUMBER	COLOR	SCHEMATICS LOCATION	DESCRIPTION
DS1	RED	8/10–8/F	GENE_PRES
DS2	RED	8/10–11/F	15 V
DS3	RED	8/10–8/C	+30V_STATIF
DS4	RED	8/10–8/C	–15VF
DS5	RED	8/10–11/B	+15 V

300PL6 AUXILIARIES CONTROL BOARD 2141876 SCH Rev 1

NUMBER	SCHEMATICS LOCATION	SIGNAL TYPE	TYPICAL VALUE OR RANGE	DESCRIPTION
TP1	2/14–10/E	DC		BIAS_LVL_OK
TP2	2/14–9/B	DC		_BIAS_LVL_OP
TP3	1/14–5/C	DC		1CHSQ
TP4	4/14–6/E			B_T6
TP5	4/14–6/D			B_T5
TP6	4/14–9/E			C_T6
TP7	4/14–9D			C_T5
TP8	4/14–6/C			B_T4
TP9	4/14–6/B			B_T3
TP10	4/14–9/C			C_T4
TP11	4/14–9B			C_T3
TP12				
TP13	4/14–6/A			B_T1
TP14	4/14–6B			B_T2
TP15	4/14–9/B			C_T2
TP16	4/14–9A			C_T1
TP17				
TP18				
TP19	1/14–3/C	DC		ICH

CENTRAL LISTING

300PL6 AUXILIARIES CONTROL BOARD 2141876 SCH Rev 1

NUMBER	SCHEMATICS LOCATION	SIGNAL TYPE	TYPICAL VALUE OR RANGE	DESCRIPTION
TP20	1/14–5/A	DC		CONS_1CHSQ
TP21	1/14–7/B	DC		INT_ERROR
TP22	1/14–7/E	DC		HEAT_T1
TP23	1/*14–7/E	DC		HEAT_T2
TP24	1/14–8/B	DC		HEAT_EN
TP25	1/14–5/E	DC		IP_MIN
TP26	1/14–5/F	DC		IN_MIN
TP27	3/14–5A	DC		
TP28				
TP29				
TP30	3/14–8A	DC		PRES_I_LC
TP31				
TP32				
TP33				
TP34				
TP35				
TP36				
TP37				
TP38				
TP38				
TP39				
TP40	3/14–5/C	DC		
TP41	3/14–5/C	DC		
TP42	2/14–4/B	DC		BIAS_ON
TP43				
TP44	2/14–4/A	DC		BIAS_FREQ
TP45				

CENTRAL LISTING

300PL6 AUXILIARIES CONTROL BOARD 2141876 SCH Rev 1

NUMBER	COLOR	SCHEMATICS LOCATION	DESCRIPTION
DS1	RED	8/4–8/D	BLINK
DS2	RED	8/14–9/D	HEAT OVLD
DS3	RED	8/10–8/D	HEAT_OP_F
DS4	RED	8/14–9/E	BIAS_OP
DS5	RED	8/14–8/E	OV_LDM_I_LC
DS6	GREEN	6/14–8/E	LVPS_OK
DS7	YELLOW	10/14–6/C	STARTER_PRES
DS8	YELLOW	10/14–7/B	STARTER_ACCEL
DS9	YELLOW	10/14–7/D	MAIN_OK
DS10	YELLOW	10/14–8/E	DC_BUS_OK
DS11	YELLOW	10/14–7/E	HEAT_OK
DS12	YELLOW	10/14–8/F	BIAS_OK
DS13	YELLOW	10/14–7/F	STARTER_OK

300PL8 HIGH VOLTAGE CONTROL BOARD 2132779 SCH Rev 1

NUMBER	SCHEMATICS LOCATION	SIGNAL TYPE	TYPICAL VALUE OR RANGE	DESCRIPTION
TP1	8/10–4D	DC		
TP2	8/10–8/A	DC		GICMD2
TP3	8/10–8A	DC		GICMD1
TP4	8/10–8/B	DC		G2CMD1
TP5	8/10–8/B	DC		G2CMD2
TP6	7/10–5/B	DC		KV_SUP_5_OUT
TP7	7/10–5/C	DC		HV_MAX_IN
TP8				
TP9				
TP10	1/10–11/F	DC	0 V	GROUND
TP11	1/10–10/F	DC	0 V	GROUND
TP12				

300PL8 HIGH VOLTAGE CONTROL BOARD 2132779 SCH Rev 1

NUMBER	SCHEMATICS LOCATION	SIGNAL TYPE	TYPICAL VALUE OR RANGE	DESCRIPTION
TP13				
TP14				
TP15	7/10–5/A	DC		KV_SUP_5_IN
TP16				
TP17	7/10–3/A	DC		
TP18				
TP19				
TP20	6/10–3/A			
TP21				
TP22	5/10–8/C	DC		KV_DEMAND
TP23	5/10–8/B	DC		
TP24	5/10–6/D	DC		
TP25	5/10–7/D	CONNECT		
		DISCONNECT		
TP26	5/10–7/D	CONNECT		
		DISCONNECT		
TP27				
TP28	6/10–3/A			
TP29	5/10–5/A	DC	–10 V	
TP30	1/10–10/F	DC	0 V	GROUND
TP31	1/10–10/F	DC	0 V	GROUND
TP32	4/10–9/D	DC		MA_MAX_IN
TP33	4/10–8/B	DC		MA_MEAS
TP34	4/10–5/E	DC		
TP35	4/10–6/A	DC		
TP36	4/10–4/B	DC		
TP37	4/10–2/C	DC		FEE_DBACK_MA
TP38	4/10–3/B	DC		

300PL8 HIGH VOLTAGE CONTROL BOARD 2132779 SCH Rev 1

NUMBER	SCHEMATICS LOCATION	SIGNAL TYPE	TYPICAL VALUE OR RANGE	DESCRIPTION
TP39	4/10–3/C			
TP40	4/10–3/B	DC		

COMPONENT	SCHEMATICS LOCATION	DESCRIPTION	FUNCTION
R6	5/10–6/E	5KΩ, 0.5W, 10%	

300PL9 POWER SUPPLY BOARD 2141877 SCH Rev 1

NUMBER	COLOR	SCHEMATICS LOCATION	DESCRIPTION
DS1	RED	5/8–6/D	+12V_OFF
DS2	GREEN	5/8–6/B	+12V_ON
DS3	YELLOW	5/8–5/F	Cde K3
DS4	GREEN	2/8–3/F	–15VM
DS5	GREEN	2/8–3/E	+15 VM
DS6	YELLOW	1/8–7/C	_PWR_DISH
DS7		3/8–3/B	DCBUS
DS8	YELLOW	1/8–4/D	_PWR_PRE
DS9	YELLOW	1/8–6/F	_PWR_ON

CIRCUIT BRKR/FUSE	RATING	NOMINAL VOLTAGE	DESCRIPTION
F1	3 A, 500 V, FAST–FUSE	220V	+SUPPLY_HEATER
F2	10 A, 500 V, FAST–FUSE	220V	+SUPPLY_START
F3	3.2A, 250 V, SLOW–BLOW FUSE	220V	AC_PHI_PRE

CENTRAL LISTING

300PL10 HIGH VOLTAGE INVERTER BOARD 2145826 SCH Rev 1

NUMBER	SCHEMATICS LOCATION	SIGNAL TYPE	TYPICAL VALUE OR RANGE	DESCRIPTION
TP1	1/3–8/B	AC		
TP2	1/3–3/B	DC		G1CMD1
TP3	1/3–10/A	DC		G11/G12
TP4	1/3–10/E	DC		G21/22
TP5	1/3–8/B	AC		
TP6	1/3–3/A	DC		G1CMD2
TP7	1/3–3/D			DRIVER
TP8	2/3–10/E			E2
TP9	2/3–10/B			
TP10	1/3–3/F	DC		G2CMD2
TP11	1/3–8/E	AC		
TP12	1/3–3/E	DC		G2CMD1
TP13	1/3–8/F	AC		
TP14				
TP15	1/3–4/A	DC	15 V	+15V_GATE
TP16	2/3–9/C			
TP17	2/3–5/B			
TP18	2/3–6/D			
TP19	2/3–6/B			
TP20				
TP21	2/3–5/E			
TP22	2/3–5/D			

300PL11 AUXILIARY POWER BOARD 2132211 SCH Rev 1

NUMBER	SCHEMATICS LOCATION	SIGNAL TYPE	TYPICAL VALUE OR RANGE	DESCRIPTION
TP1	2/3–5/B	DC	0 V	GROUND
TP2	2/3–2/F	DC		BIAS_CDE_T2

300PL11 AUXILIARY POWER BOARD 2132211 SCH Rev 1

NUMBER	SCHEMATICS LOCATION	SIGNAL TYPE	TYPICAL VALUE OR RANGE	DESCRIPTION
TP3	2/3–3/A	DC	+12 V	_12V_BIAS_PWR
TP4	2/3–2/D	DC		BIAS_CDE_T1
TP5	2/3–E/E			
TP6	2/3–3/C	DC	–12 V	–12V_BIAS_PWR
TP7	2/3–6/E			
TP8	1/3–5/D			
TP9	1/3–5/C			
TP10	1/3–5/B			
TP11	1/3–5/A			+SUPPLY_HEATER
TP12	1/3–5/A			

NUMBER	COLOR	SCHEMATICS LOCATION	DESCRIPTION
DS1	GREEN	2/3–4/C	–12V_BIAS_PWR
DS2	GREEN	2/3–4/B	+12V_BOAS_PWR
DS3			
DS4	YELLOW	1/3–7/F	_TRACK_2_SEL

300PL12 ANODE STARTER POWER BOARD 45553694 SCH Rev 1

NUMBER	SCHEMATICS LOCATION	SIGNAL TYPE	TYPICAL VALUE OR RANGE	DESCRIPTION
TP1	1/3–2/C	AC		CDE_T1
TP2	1/3–3/C	AC		BLOC_T1
TP3	1/3–2/E	AC		CDE_T2
TP4	1/3–3/E	AC		BLOC_T2
TP5	2/3–3/C			CDE_T3
TP6	2/3–3/C			BLOC_T3
TP7	2/3–3/E			CDE_T4
TP8	1/3–2/B	DC	+12 V	+12V_COUPE
TP9	2/3–3/E			BLOC_T4

300PL12 ANODE STARTER POWER BOARD 45553694 SCH Rev 1

NUMBER	SCHEMATICS LOCATION	SIGNAL TYPE	TYPICAL VALUE OR RANGE	DESCRIPTION
TP10	2/3–7/C	AC		CDE_T5
TP11	2/3–7/C	AC		BLOC_T5
TP12	2/3–7/E	AC		BLOC_T6
TP13	2/3–7/E	AC		CDE_T6
TP14	1/3–5/D	AC		
TP15	1/3–7/D			PHASE_2
TP16				
TP17	1/3–7/E			
TP18	1/3–5/F	AC		SUR_1_B
TP19	1/3–6/D	AC		0V_PHASE_1
TP20	1/3–5/D	AC		MESURE_PHASE_1
TP21	1/3–8/D	AC		MESURE_PHASE_3
TP22	1/3–11/B	DC		+250V
TP23	1/3–11/F	DC	250 V	0V 250V
TP24	1/3–8/D	AC	0 V	0V_PHASE_3
TP25	1/3–5/E	AC		SUR_I_H

300PL13 GANTRY SUPPLY 2128521 SCH Rev 1

CIRCUIT BRKR/FUSE	RATING	NOMINAL VOLTAGE	DESCRIPTION
F1	10 A, 250V, SLOW–BLOW FUSE	+27VDC	+27VDC_LIGHT_ROT
F2	10A, 250V, SLOW–BLOW FUSE	+27VDC	+27VDC_CONT_PANEL
F3	3.2A, 250V, SLOW–BLOW FUSE	+27VDC	+27VDC_ELEV_COMP

300PL15 HIGH VOLTAGE MEASURE BOARD 2130712 SCH Rev 1

NUMBER	SCHEMATICS LOCATION	SIGNAL TYPE	TYPICAL VALUE OR RANGE	DESCRIPTION
TP1	1/1–5/C	DC	0 V	GROUND
TP2	1/1–5/D			

COMPONENT	SCHEMATICS LOCATION	DESCRIPTION	FUNCTION
R1	1/1–7/D	50KΩ, 0.5W, 10%	

CENTRAL LISTING

300PL17 LV DISTRIBUTION BOARD 2141759 SCH Rev 1

NUMBER	COLOR	SCHEMATICS LOCATION	DESCRIPTION
DS1	YELLOW	1/3–8/E	LVS_PRE
DS2	YELLOW	2/3–6/E	Cde_K1
DS3	YELLOW	1/3–10/F	LVS–ON
DS4	GREEN	1/3–2/D	+15 VBF
DS5	GREEN	1/3–3/C	+15 VS
DS6	GREEN	1/3–2/F	+5 VBF
DS7	GREEN	1/3–3/F	+5 VS
DS8	GREEN	1/3–2/E	–15 VBF
DS9	GREEN	1/3–3/E	–15 VS
DS10	NEON LAMP	2/3–9/F	DC BUS SUPPLIES LVPS

CIRCUIT BRKR/FUSE	RATING	NOMINAL VOLTAGE	DESCRIPTION
F1	3.2A, 250V, SLOW–BLOW FUSE	+15VDC	+15VBF
F2	3.2A, 250V, SLOW–BLOW FUSE	+5VDC	+5VBF
F3	1A, 250V, SLOW–BLOW FUSE	–15VDC	–15VBF
F4	2A, 250V, SLOW–BLOW FUSE	15VAC	AC_PHI+RETURN

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CHAPTER 3 – CALIBRATION

SECTION 1
INTRODUCTION

The information in this chapter is useful to the service engineer when it is suspected that the Senographe 700T and Senographe 800T generator and/or gantry is out calibration and a complete re–calibration is deemed necessary.

This chapter is divided into 5 sections:

- Section 1 introduces the chapter.
- Section 2 selects the Senographe type 700T or 800T.
- Section 3 provides information for complete generator calibration (except AEC calibration for a given screen pair).
- Section 4 provides information for complete gantry calibration.
- Section 5 calibration Job Cards.

SECTION 2
SENOGRAPHE TYPE

1. Select Senographe type by selecting from application mode
   SETUP/INSTALL/CONFIG/TYPE/700T or 800T

SECTION 3
GENERATOR CALIBRATION

1. Check jumpers and switches
   See Job Card IST 007 ”JUMPERS AND SWITCHES”.
2. Calibrate X–ray tube kV scale factor
   See Job Card CAL 017 ”CALIBRATION OF kV SCALE FACTOR”.
3. Calibrate X–ray tube mA measurement.
   See Job Card CAL 016 ”CALIBRATION OF X–RAY TUBE mA MEASUREMENT”.
4. Calibrate X–ray tube heater current scale factor
   See Job Card CAL 001 ”CALIBRATION OF HEATER CURRENT SCALE FACTOR”.
5. Calibrate X–ray tube focal bias voltage.
   See Job Card CAL 002 ”CALIBRATION OF X–RAY TUBE FOCAL BIAS VOLTAGE FACTOR”.
6. Calibrate X–ray tube heater current
   See Job Card CAL 003 ”CALIBRATION OF X–RAY TUBE HEATER CURRENT.
7. Calibrate photo cell HV measurement and scale factor.
   See Job Card CAL 004 ”CALIBRATION OF PHOTO CELL HV MEASUREMENT AND SCALE FACTOR”.

CALIBRATION

8. Calibrate photo cell sensitivity as a function of its voltage

   See Job Card CAL 005 ”CALIBRATION OF PHOTO CELL SENSITIVITY AS A FUNCTION OF ITS VOLTAGE”.

SECTION 4 GANTRY CALIBRATION

1. Check jumpers and switches

   See Job Card IST 007 ”JUMPERS AND SWITCHES”

2. Calibrate compression force detector

   See Job Card CAL 019 ”CALIBRATION OF COMPRESSION FORCE DETECTOR”

3. Test minimum compression/decompression forces.

   See Job Card CAL 020 ”MINIMUM COMPRESSION/DECOMPRESSION FORCE TESTS”

4. Calibrate breast thickness measurement

   See Job Card CAL 009 ”CALIBRATION OF BREAST THICKNESS MEASUREMENT”

5. Calibrate angle measurement

   See Job Card CAL 008 ”CALIBRATION OF EXAMINATION ARM ANGLE MEASUREMENT”

6. Check X–ray film format geometry

   See Job Card CAL 021 ”CHECKING X–RAY FILM FORMAT GEOMETRY” (mechanical adjustment)

7. Test for absenceof grid lines on exposed film

   See Job Card CAL 018 ”TEST FOR ABSENCE OF GRID LINES ON EXPOSED FILM”

SECTION 5
CALIBRATION JOB CARDS

JOB CARD No.	PURPOSE
CAL 001	CALIBRATION OF HEATER CURRENT SCALE FACTOR
CAL 002	CALIBRATION OF X–RAY TUBE FOCAL BIAS VOLTAGE FACTOR
CAL 003	CALIBRATION OF X–RAY TUBE HEATER CURRENT
CAL 004	CALIBRATION OF PHOTO CELL HV MEASUREMENT AND SCALE FACTOR
CAL 005	CALIBRATION OF PHOTO CELL SENSIBILITY AS A FUNCTION OF ITS VOLTAGE
CAL 006	SCREEN PAIR SELECTION AND CONFIGURATION
CAL 007A	CALIBRATION OF PHOTOMULTIPLIER CELL GAIN FOR A GIVEN SCREEN PAIR (FOR SYSTEMS WITH SOFTWARE <= V2.21)
CAL 007B	CALIBRATION OF PHOTOMULTIPLIER CELL GAIN FOR A GIVEN SCREEN PAIR (FOR SYSTEMS WITH SOFTWARE >= V2.31)
CAL 008	CALIBRATION OF EXAMINATION ARM ANGLE MEASUREMENT
CAL 009	CALIBRATION OF BREAST THICKNESS MEASUREMENT
CAL 010	AUTOMATIC X–RAY TUBE WARM–UP
CAL 011	SETTING OF ELEVATOR UPPER TRAVEL LIMIT
CAL 012	CHECKING SAFE–LIGHTING AND FILM PROCESSING
CAL 013A	CALIBRATION OF FILM RECIPROCITY LAW FAILURE COMPENSATION FOR A GIVEN SCREEN PAIR (FOR SYSTEMS WITH SOFTWARE <= V2.21)
CAL 013B	CALIBRATION OF FILM RECIPROCITY LAW FAILURE COMPENSATION FOR A GIVEN SCREEN PAIR (FOR SYSTEMS WITH SOFTWARE >= V2.31)
CAL 014A	CALIBRATION OF REFERENCE ENERGY FOR A GIVEN SCREEN PAIR (FOR SYSTEMS WITH SOFTWARE <= V2.21)
CAL 014B	CALIBRATION OF REFERENCE ENERGY FOR A GIVEN SCREEN PAIR (FOR SYSTEMS WITH SOFTWARE >= V2.31)
CAL 015	CHECKING THE MAINS SUPPLY FOR A FULL POWER USE
CAL 016	CALIBRATION OF X–RAY TUBE mA MEASUREMENT
CAL 017	CALIBRATION OF kV SCALE FACTOR
CAL 018	TEST FOR ABSENCE OF GRID LINES ON EXPOSED FILM
CAL 019	CALIBRATION OF COMPRESSION FORCE DETECTOR
CAL 020	MINIMUM COMPRESSION/DECOMPRESSION FORCE TESTS
CAL 021	CHECKING X–RAY FILM FORMAT GEOMETRY
CAL 022	MANUAL DETERMINATION OF AOP STRATEGY FOR A GIVEN SCREEN PAIR

CAL 023	GENERAL ERRORS DURING THE CALIBRATION
CAL 024	+5V LVPS ADJUSTMENT
CAL 025	CHECK AND ADJUSTMENT OF CENTERING DEVICE LAMP
CAL 026	CHECK AND ADJUSTMENT OF ELEVATOR SAFETY SWITCH
CAL 050	A0 OPTIMIZATION IN CONTACT MODE
CAL 051	A0 OPTIMIZATION IN MAGNIFICATION MODE

Senographe 700T and 800T — Job Card CAL 001

Purpose: **CALIBRATION OF HEATER CURRENT SCALE FACTOR**	Version No.: A Date: Dec. 18, 1995
Time: x h xx min	Personnel:

SECTION 1
SUPPLIES

None.

SECTION 2
TOOLS

- True r.m.s. a.c. ammeter.

Note: When using the Fluke 87, you must use the **RANGE** button to manually select the 40 Amp AC range. A Fluke 87 or equivalent meter MUST be used to measure the heater current.

- HV unit HV cable adaptor, Part number 36003399.

SECTION 3
SAFETY PRECAUTIONS

CAUTION

In case of equipment breakdown or service engineer error during this calibration procedure, the resulting parameter values might become so unreasonable as to render the X–ray tube filament supply circuit unusable. This can show up as an error message during power up, and thus inhibit use of the calibration software. If this happens, the only way to cancel the error is to manually re–enter the default parameter values (see section 5 for default parameter values) and switch the Senographe off and back on again before again attempting a calibration.

SECTION 4
PREREQUISITES

Note: In case of error messages during this calibration, see CAL 023 ”GENERAL ERRORS DURING THE CALIBRATION” for explanations.

SECTION 5
CALIBRATION OF HEATER CURRENT SCALE FACTOR

The objective is to determine the scale factor K and fixed offset VOF between the X–ray tube filament current command from the software and the real filament current value obtained. Each tube track has its own filament supply circuit, so this calibration procedure is to be performed for each of the two tracks.

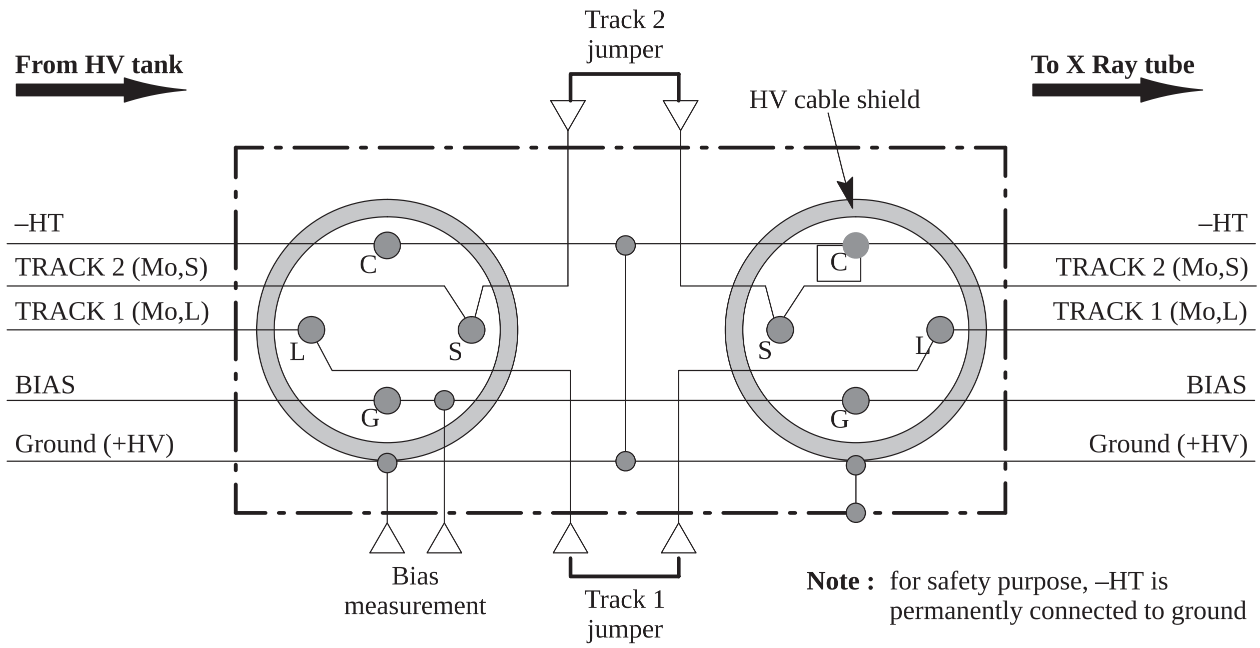
DEFAULT PARAMETER VALUES ARE K = +1.10E+1 (11.0) AND VOF = +0.000E+0 (0.0).

5.1 Prepare the Senographe for this calibration procedure.

1. Turn off the Senographe. Open mains disconnector 300 S1.
2. Open the HV converter control signal inputs by disconnecting flat cable W6 from generator arm interface board 300PL5 connector J5. This eliminates any possibility of energy build–up in the HV unit during this calibration procedure.
3. Loosen small Allen screen in HV ring and disconnect the HV cable at the HV tank end.
4. Connect the true r.m.s. a.c. ammeter in series with the filament being calibrated, using the HV tank HV cable adaptor (see Illustrations 1 and 2).

Note: Keep the other filament connected in order to avoid error messages when the Senographe is switched on.

ILLUSTRATION 1
HV UNIT HV CABLE ADAPTOR 36003399

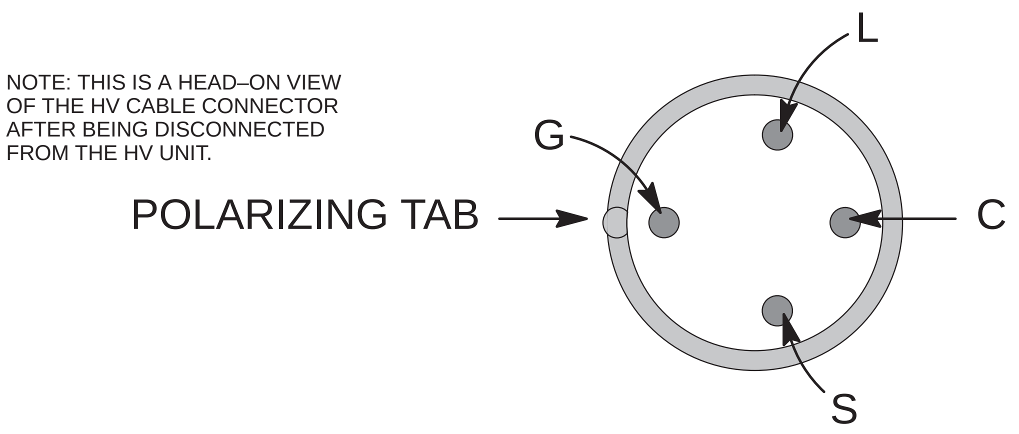


CALIBRATION OF HEATER CURRENT SCALE FACTOR Job Card CAL 001 3 of 6

Note: Reconnect the HV cable terminals to the HV tank terminals using the HV tank cable adapter.

Note: Reconnect the HV cable terminals to the HV tank terminals using the HV tank HV cable adapter.

ILLUSTRATION 2
HV CABLE CONNECTOR PIN CONNECTION DIAGRAM



The HV cable connector is marked with the standard X–ray industry markings (L, S, C and G). However, the functions of the corresponding conductors in the Senographe are as follows:

- L = track 1 (Mo) filament supply
- S = track 2 (Mo) filament supply
- C = filament supply return and X–ray tube cathode HV
- G = focal bias voltage supply

5. Close mains fuse disconnect 300 S1 and switch on the Senographe.

Note: ERROR E01 Generator Failure 007/xxx is normal with 300PL5 J5 disconnect.

6. Change the position of the installation menu enable switch (switch 8 of B1 on 300PL4 CPU board, see ”Accessing the Different Installation Menus in the Tree Structure” in Chapter 1).

Note: To access to the installation menus you can select the ”PASSWD” key and compose the password (given at the training course). And press the ”SETUP” key.

CALIBRATION

CALIBRATION OF HEATER CURRENT SCALE FACTOR — Job Card CAL 001 — 4 of 6

5.2 Perform the calibration procedure for the desired X–ray tube track.

1. Select **SETUP/INSTAL/GENE/HTR_SCL/TRACK1** (*or* **TRACK2) /CALIB/1st pt/CALIB** on the console for the first calibration point.

Note: The default filament current command value for this first point is + 4.000E + 00 (4.0) A.

2. Press the 2nd trigger button (no X–rays are produced) and hold it until the ammeter reading stabilizes (this may take a few seconds).
3. Note the filament current value measured from the ammeter.
4. Release the 2nd trigger button.
5. Select **SETUP/MeasI** on the console.
6. Enter and validate the measured filament current value from the ammeter for this first calibration point.
7. Select **SETUP/SETUP/2nd pt/CALIB** on the console for the first calibration point.

Note: The default filament current command value for this second point is +5.000E+00 (5.0) A.

8. Press the 2nd trigger button (no X–rays are produced) and hold it until the ammeter reading stabilizes (this may take a few seconds).
9. Note the filament current value measured from the ammeter.
10. Release the 2nd trigger button.
11. Select **SETUP/MeasI** on the console.
12. Enter and validate the measured filament current value from the ammeter for this second calibration point.
13. Select **SETUP/SETUP/calcul/VALID** on the console. This executes the calculation of the scale factor and fixed offset of the filament current command from the software.

5.3 Check the calibration accuracy.

1. Select **SETUP/1st pt/CALIB** on the console.

Note: Again, the default filament current command value for this first point is +4.000E+00 (4.0) A.

2. Press the 2nd trigger button (no X–rays are produced) and hold it until the ammeter reading stabilizes (this may take a few seconds).
3. Note the filament current value measured from the ammeter.
4. Release the 2nd trigger button.
5. Select **SETUP/SETUP/2nd pt/CALIB** on the console.

CALIBRATION OF HEATER CURRENT SCALE FACTOR

Job Card CAL 001

Note: Again, the default filament current command value for this second point is +5.000E+00 (5.0) A.

6. Press the 2nd trigger button (no X–rays are produced) and hold it until the ammeter reading stabilizes (this may take a few seconds).
7. Note the filament current value measured from the ammeter.
8. Release the 2nd trigger button.
9. The expected results are 4.0 ± 0.01 A ± ammeter tolerance for the first point and 5.0 ± 0.01 A ± ammeter tolerance for the second point. If the results are within these tolerances, the calibration for this X–ray tube track is finished. If the results are out of tolerance, repeat the calibration procedure in section 5.2 and the check procedure in section 5.3 for the same X–ray tube track.

Note: Performing the calibration procedure once is normally sufficient for correct calibration.

Note: If it is necessary to perform the calibration procedure more than once, the measured values of current for the two points (4.0 and 5.0 A) should become increasingly accurate. If not, the procedure is probably not being followed correctly.

10. Select **SETUP/SETUP/SETUP/PARAM** on the console. Note down the calculated values of scale factor K and offset VOF. Each of these two values can be displayed alternately by rotating the kV dial on the console.

CAUTION **If the value of K is less than +8.000E+0 (8.0), either the calibration procedure was done incorrectly or there is a hardware defect.**

11. Repeat the calibration and check procedures on the other tube track, if necessary.
12. Perform a "CKSUM" and return to application mode, then turn the system off, and open mains fuse disconnector 300 S1
13. Re–connect flat cable W6 to generator command board 300PL5 connector J5, remove high voltage cable adapter. Do not forget to secure the HV ring with the Allen screw, to insure proper ground continuity.
14. Close mains fuse disconnector 300 S1.

CALIBRATION OF HEATER CURRENT SCALE FACTOR

Job Card CAL 001

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Senographe 700T and 800T Job Card CAL 002

Purpose: **CALIBRATION OF X–RAY TUBE FOCAL BIAS VOLTAGE FACTOR**	Version No.: A Date: Dec. 18, 1995
Time: x h xx min	Personnel: 1

SECTION 1
SUPPLIES

None.

SECTION 2
TOOLS

- Voltmeter.

Note: When using the Fluke 87, you must use the **RANGE** button to manually select the VDC range. A Fluke 87 or equivalent meter MUST be used to measure the heater current.

- HV unit HV cable adaptor: part number 36003399.

SECTION 3
SAFETY PRECAUTIONS

CAUTION

In case of equipment breakdown or service engineer error during this calibration procedure, the resulting parameter values might become so unreasonable as to render the X–ray tube focal bias voltage supply circuit unusable. This can show up as an error message during power up, and thus inhibit use of the calibration software. If this happens, the only way to cancel the error is to manually re–enter the default parameter values (see section 5 for default parameter values) and switch the Senographe off and back on again before again attempting a calibration.

SECTION 4
PREREQUISITES

Job Card IST 001 ”CALIBRATION OF HEATER CURRENT SCALE FACTOR”.

Note: In case of error messages during this calibration, see CAL 023 ”GENERAL ERRORS DURING THE CALIBRATION” for explanations.

SECTION 5
CALIBRATION OF X–RAY TUBE FOCAL BIAS VOLTAGE SCALE FACTOR

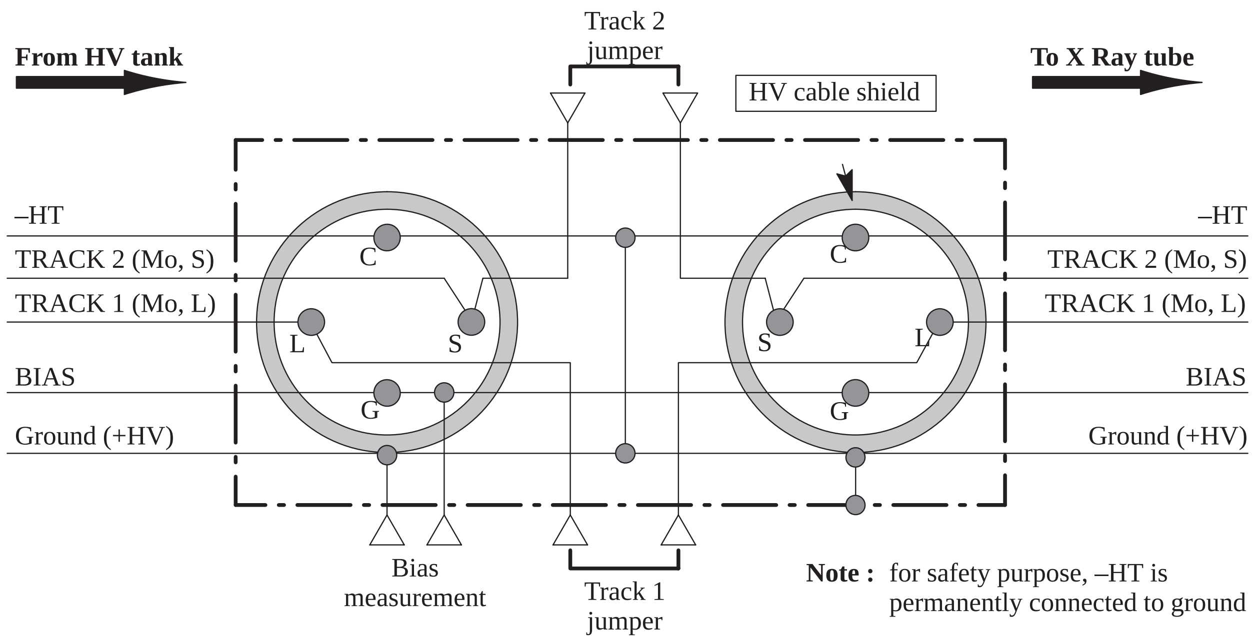
The objective is to determine the scale factor alpha and offset beta between the X–ray tube focal bias voltage command from the software and the real focal bias voltage value obtained. The focal bias voltage applied to the X–ray tube electron beam concentration device establishes the focal spot width.

DEFAULT PARAMETER VALUES ARE ALPHA = +8.38E+1 (83.8) AND BETA = –3.88E+2 (–388).

5.1 Prepare the for this calibration procedure.

1. Turn off the Senographe and open mains fuse disconnector and 300 S1.
2. Open the HV converter control signal inputs by disconnecting flat cable W6 from generator arm interface board 300PL5 connector J5. This eliminates any possibility of energy build–up in the HV unit during this calibration procedure.
3. Loosen small Allen screw in HV ring and disconnect the HV cable at the HV tank end.
4. Re–connect the HV cable terminals to the HV tank terminals using the HV tank HV cable adaptor. Connect a DC voltmeter between common (C) and the focal bias voltage wire (G). (See Illustrations 1 and 2.)

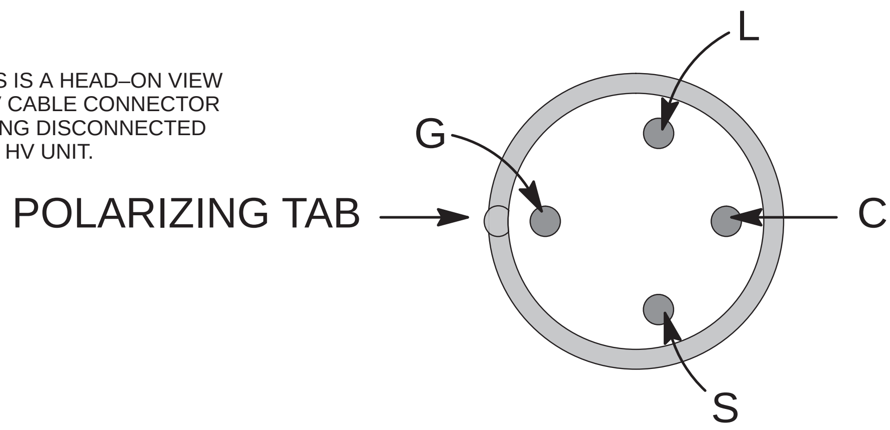
ILLUSTRATION 1
HV UNIT HV CABLE ADAPTOR 36003399



CALIBRATION OF X–RAY TUBE FOCAL BIAS VOLTAGE FACTOR Job Card CAL 002 3 of 6

ILLUSTRATION 2
HV CABLE CONNECTOR PIN CONNECTION DIAGRAM

NOTE: THIS IS A HEAD–ON VIEW OF THE HV CABLE CONNECTOR AFTER BEING DISCONNECTED FROM THE HV UNIT.



The HV cable connector is marked with the standard X–ray industry markings (L, S, C and G). However, the functions of the corresponding conductors in the are as follows:

- L = track 1 (Mo) filament supply
- S = track 2 (Mo) filament supply
- C = filament supply return and X–ray tube cathode HV
- G = focal bias voltage supply

5. Close mains fuse disconnector 300 S1 and switch on the Senographe.

   ERROR E01 Generator Failure 007/xxx is normal with 300PL5 J5 disconnected.

6. Change the position of the installation menu enable switch (switch 8 of B1 on 300PL4 CPU board , see ”Accessing the Different Installation Menus in the Tree Structure” in Chapter 1).

Note: To access to the installation menus you can select the ”PASSWD” key and compose the password (given at the training course). And press the ”SETUP” key.

7. Select **SETUP/INSTAL/GENE/BIAS/RESIST** on the console.

CALIBRATION

8. Check the value of the resistance is:
   - Res = +3.400 E + 3

     If this value is different, modify it by using the CHANGE key, rotating the kV dial and using the NEXT, VALID and SETUP keys. See ”Visual Display of Parameter Values” and ”Modification of a Parameter Value or Entry of a Measurement” in Chapter 1.

5.2 Perform the calibration procedure.

1. Select **SETUP/CALIB/1st pt/CALIB** on the console for the first calibration point.
2. Press the 2nd trigger button (no x–rays are produced) and hold it until the voltmeter reading stabilizes.
3. Note the focal bias voltage value measured from the voltmeter.
4. Release the 2nd trigger button.
5. Select **SETUP/MeasV** on the console.
6. Enter and validate the absolute value of measured focal bias voltage value from the voltmeter for this first calibration point. See ”Entry of an Alpha–Numeric Value” in Chapter 1 for information on entering alpha–numeric values.
7. Select **SETUP/SETUP/2nd pt/CALIB** on the console for the second calibration point.
8. Press the 2nd trigger button (no x–rays are produced) and hold it until the voltmeter reading stabilizes.
9. Note the focal bias voltage value measured from the voltmeter.
10. Release the 2nd trigger button.
11. Select **SETUP/MeasV** on the console.
12. Enter and validate the measured focal bias voltage value from the voltmeter for this second calibration point.
13. Select **SETUP/SETUP/calcul/VALID** on the console. This executes the calculation of the parameters alpha and beta. The message ”CALCUL DONE” appears on the console display.

5.3 Check the calibration accuracy.

1. Select **SETUP/1st pt/CALIB** on the console.
2. Press the 2nd trigger button (no x–rays are produced) and hold it until the voltmeter reading stabilizes.
3. Note the focal bias voltage value measured from the voltmeter for the first point.
4. Release the 2nd trigger button. DO NOT ENTER THIS MEASURED VALUE.
5. Select **SETUP/SETUP/2nd pt/CALIB** on the console.
6. Press the 2nd trigger button (no x–rays are produced) and hold it until the voltmeter reading stabilizes.
7. Note the focal bias voltage value measured from the voltmeter for the second point.
8. Release the 2nd trigger button. DO NOT ENTER THIS MEASURED VALUE.
9. The expected results for the first point (50V) and second point (136V) must be within + or – 5% tolerance. If the results are within these tolerances, the focal bias voltage calibration is finished. If the results are out of tolerance, repeat the calibration procedure in section 5.2 and the check procedure in Section 5.3.

Note: Performing the calibration procedure once is normally sufficient for correct calibration.

Note: If it is necessary to perform the calibration procedure more than once, the measured values of focal bias voltage for the two points should become increasingly accurate. If not, the procedure is probably not being followed correctly.

10. Select **SETUP/SETUP/SETUP/PARAM** on the console. Note down the calculated values of parameters alpha and beta. Each of these two values can be displayed alternately by rotating the kV dial on the console.
11. Perform a ”CKSUM” and return to application mode, then turn the system off. Open mains fuse disconnector 300 S1.
12. Re–connect flat cable W6 to 300PL5 generator arm Interface board 300PL5 connector J5, remove high voltage cable adapter. Do not forget to secure the HV ring with the Allen screw, to insure proper ground continuity.
13. Close mains fuse disconnector 300 S1.

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Senographe 700T and 800T Job Card CAL 003 1 of 4

Purpose: **CALIBRATION OF X–RAY TUBE HEATER CURRENT**	Version No.: A Date: Dec. 18, 1995
Time: x h xx min	Personnel: 1

SECTION 1
SUPPLIES

None.

SECTION 2
TOOLS

None.

SECTION 3
SAFETY PRECAUTIONS

CAUTION

This procedure produces X–rays. Be sure to take appropriate precautions.

SECTION 4
PREREQUISITES

The following procedures must have been performed in the following order:

- Job Card CAL 017 ”CALIBRATION OF kV SCALE FACTOR”
- Job Card CAL 016 ”CALIBRATION OF X–RAY TUBE mA MEASUREMENT”
- Job Card CAL 001 ”CALIBRATION OF HEATER CURRENT SCALE FACTOR”
- Job Card CAL 002 ”CALIBRATION OF X–RAY TUBE FOCAL BIAS VOLTAGE FACTOR”

Note: In case of error messages during this calibration, see CAL 023 ”GENERAL ERRORS DURING THE CALIBRATION” for explanations.

CALIBRATION

SECTION 5
CALIBRATION OF X–RAY TUBE HEATER CURRENT

The objective is to determine the x–ray tube heater current necessary for producing the desired x–ray tube anode current at a given kV value.

The calibration procedure must be performed on each focal size. Two repetitions of the calibration procedure are therefore necessary.

Three exposures are taken automatically at different kV values. Using the results, the software calculates the necessary parameters to be able to determine the x–ray tube heater current needed to produce the desired x–ray tube anode current for **all** possible kV values.

5.1 Perform the calibration procedure.

1. Perform the calibration procedure on the LF/MO focal size first, then on the other (SF/MO).
2. Starting from application mode, change the position of the installation menu enable switch (switch 8 of B1 on 300PL4 CPU board, see ”Accessing the Different Installation Menus in the Tree Structure” in Chapter 1).

Note: This must only be done if the Senographe has been switched off since the last access to **SETUP/INSTAL**

Note: To access to the installation menus you can select the ”PASSWD” key and compose the password (given at the training course). And press the ”SETUP” key.

CAUTION — **Protect the photocell with 4 cm of plexiglass.**

3. Select the following menu sequence on the console:
   SETUP/INSTAL/GENE/TUBE/HEATER/*focal size/track*/CALIB
4. Press the 2nd trigger button and hold it down. The messages ”EXPOSURE NO 1”, ”EXPOSURE NO 2”, ”EXPOSURE NO 3” and ”CALIBRATION END” appear sequentially on the console display. The software automatically performs the three exposures and the calculations.

Note: Calibration time varies according to tube temperature. The message ”TOO HOT” appears on the console display when tube temperature is excessive for taking the next exposure. It is not necessary to hold the 2nd trigger button down while waiting for the tube to cool. However, DO NOT exit the calibration menu while waiting. As soon as the ”TOO HOT” message disappears, continue the calibration by pressing the 2nd trigger button and holding it down.

Note: In case of arcing, the software re–attempts the same exposure automatically.

Note: The calibration procedure includes an exposure at 35 kV. If for some reason this exposure is impossible to perform (e.g. excessive arcing), tube warm–up may be necessary.
See Job Card CAL 010 ”AUTOMATIC X–RAY TUBE WARM–UP”.

5. Repeat Sections 3. to 4. for the remaining focal spots.

Note: It’s not usefull to change the collimator.

5.2 Check the results.

1. Be sure that the gantry presence parameter PRES_A is set to ”yes” before proceeding. See ”Gantry Present/Absent” in Chapter 1.
2. Activate the display of parameters following an exposure. See ”Display of Parameters Following an Exposure” in Chapter 1.
3. Perform a ”CKSUM” and return to application mode.
4. Set up the Senographe for a manual (2–point) exposure at 30 kV and 50 mAs. For each of the focal sizes, take an exposure following a 3–second preparation time (put the right collimator). Note the resulting X–ray tube anode currents displayed on the console display.
5. The table below shows the expected x–ray tube anode current for each focal size/track combination:
   - LF/MO – 100 mA ± 5%.
   - SF/MO – 30 mA ± 5%.
6. If you’re turning the machine back over to the user at this point, switch the Senographe off, then on again.

CALIBRATION

CALIBRATION OF X–RAY TUBE HEATER CURRENT Job Card CAL 003 4 of 4

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Senographe 700T and 800T Job Card CAL 004

Purpose: **CALIBRATION OF PHOTO CELL HV MEASUREMENT AND SCALE FACTOR**	Version No.: A Date: Dec. 18, 1995
Time: x h	Personnel: 1

SECTION 1
SUPPLIES

None.

SECTION 2
TOOLS

- Voltmeter (Range: 1000 V DC).
- Service terminal.

SECTION 3
SAFETY PRECAUTIONS

WARNING

THESE CALIBRATION PROCEDURES INVOLVE CONNECTING A VOLTMETER TO THE PHOTO CELL HIGH VOLTAGE SUPPLY CIRCUITS WHICH OPERATE AT APPROXIMATELY 800 VDC. USE APPROPRIATE PRECAUTIONS WHEN COMING INTO CLOSE PROXIMITY OF THESE CIRCUITS.

CAUTION

In case of equipment breakdown or service engineer error during these calibration procedures, the resulting parameter values might become so unreasonable as to render the photo cell board unusable. This can show up as an error message during power up, and thus inhibit use of the calibration software. If this happens, the only way to cancel the error is to manually re–enter the default parameter value (see sections 5 and 6 for default parameter values) and switch the Senographe off and back on again before attempting a new calibration.

Note: These two calibration procedures must always be done together and in the order presented. Follow the procedure in section 5 and then the procedure in section 6.

SECTION 4
PREREQUISITES

Note: In case of error messages during this calibration, see CAL 023 ”GENERAL ERRORS DURING THE CALIBRATION” for explanations.

CALIBRATION

CALIBRATION OF PHOTO CELL HV MEASUREMENT AND SCALE FACTOR Job Card CAL 004 2 of 4

SECTION 5
CALIBRATION OF PHOTO CELL HV MEASUREMENT

The objective is to determine the scale factor F/HV between the real photo cell HV value and the photo cell HV measurement input to the software. This is accomplished by sending a theoretical photo cell HV command value of +7.000E+2 (700) V from the software and measuring the real voltage obtained. The measured value is entered and the software calculates the value of F/HV.

DEFAULT PARAMETER VALUE IS F/HV = +1.365E+2 (136.5) Hz/V

5.1 Prepare the Senographe for this calibration procedure.

1. Switch off the Senographe**.**
2. Remove the bucky and unscrew the cover to access the photocell. Carefully connect a voltmeter set to 1000 VDC to the photo cell HV, between test point TP1 and TP2, marked ”–HV”).
3. Switch on the Senographe**.**
4. Starting from application mode, change the position of the installation menu enable switch (switch 8 of B1 on 300PL4 CPU board, see ”Accessing the Different Installation Menus in the Tree Structure” in Chapter 1).

Note: This must only be done if the Senographe has been switched off since the last access to **SETUP/INSTAL**

Note: To access to the installation menus you can select the ”PASSWD” key and compose the password (given at the training course). And press the ”SETUP” key.

5. Ensure that the gantry is present by selecting **SETUP/INSTAL/CONFIG/ PRS_A/YES** on the console (see ”Gantry Present/Absent (”PRS_A”) in Chapter 1).

5.2 Perform the calibration procedure.

1. Select **SETUP/SETUP/AOP/CELL/ HV/DAC / FREQ/HV /CALIB/CALIB/START** on the console. The message ”working” appears on the console display.
2. Wait for the voltmeter reading to stabilize, and note its absolute (positive) value.
3. Select **STOP** on the console. The message ”done” appears on the console display.

Note: After you press **STOP** the voltage reading is no longer significant.

4. Select **SETUP/HV_M** on the console.
5. Enter and validate the absolute (positive) value of the voltmeter reading from step 2. in Section 5.2, by using the NEXT and VALID keys and the kV dial. See ”Visual Display of Parameter Values” and ”Modification of a Parameter Value or Entry of a Measurement” in Chapter 1.
6. Select **SETUP/CALC/VALID** on the console. The message ”calcul done” appears on the console display.

SECTION 6
CALIBRATION OF PHOTO CELL HV SCALE FACTOR

The objective is to determine the scale factor (alpha) and offset (beta) between the photo cell HV command value from the software and the real photo cell HV value obtained. The calibration is fully automatic.

DEFAULT PARAMETER VALUES ARE ALPHA = +3.648E+0 (3.648) AND BETA = +8.838E+1 (88.38).

6.1 Perform the calibration procedure.

1. Select **SETUP/SETUP/SETUP/ HV/DAC /CALIB/START** on the console. The messages ”working”, then ”done” appear on the console display.
2. Select **SETUP/PARAM** on the console. Note down the calculated values of scale factor alpha and offset beta. Each of these two values is displayed alternately by rotating the kV dial on the console.
3. Perform a checksun and return to applications.

6.2 Check the checksum accuracy.

1. Select **SETUP/INSTAL/AOP/CELL/HV/DAC/CHECK** on the console.
2. Select **REF** and verify the HV parameter (High voltage wanted). This parameter must be equal to + 4.000E + 2 (400volts). If not, correct it using the CHANGE key. (See Modification of a Parameter Value or Entry of a Measurement in Chapter 1). The HV parameter is the tension send by the software to the PM.
3. Select **SETUP/TEST**
4. Note down the value displayed on the console after it has stabilized (High voltage read). Check that the value displayed on the console is equal to 400V +/–5. Check that the value read by voltmeter is equal to 400V+/–4 + volmeter error.
5. Select **SETUP/REF/CHANGE**
6. Enter and validate a HV parameter value of +6.00E + 2 (600V) using the **NEXT** and **VALID** keys of the kV dial.
7. Select **SETUP/SETUP/TEST**
8. Note down the value displayed on the console after it has stabilized (High voltage read). Check that the value displayed is equal to 600 V +/–5. Check that the value read by voltmeter is equal to 600 V +/–6 + volmeter error.
9. Select **SETUP/REF/CHANGE**
10. Enter and validate a HV parameter value of +8.00E + 2 (800V) using the next and valid keys of the kV dial.

CALIBRATION OF PHOTO CELL HV MEASUREMENT AND SCALE FACTOR

Job Card CAL 004

11. Select **SETUP/REF/CHANGE**
12. Enter and validate a HV parameter value of +9.00E + 2 (900V) using the next and valid keys of the kV dial.
13. Select **SETUP/SETUP/TEST**
14. Note down the value displayed on the console after it has stabilized (High voltage read). Check that the value displayed on the console is equal to 900V +/–5. Check that the value read by the voltmeter is equal to 900V +/–8 +voltmeter error.
15. Return to application mode.
    a. Switch off the Senographe.
    b. Replace the translucent cover with the 8 screws.
    c. Reinstall the bucky.

Senographe 700T and 800T Job Card CAL 005 1 of 4

Purpose: **CALIBRATION OF PHOTO CELL SENSITIVITY AS A FUNCTION OF ITS VOLTAGE**	Version No.: A Date: April 5, 2001
Time: x h xx min	Personnel: 1

SECTION 1
SUPPLIES

None.

SECTION 2
TOOLS

Plexiglass in thickness increments of 1 cm (minimum plexiglass dimensions 15 x 15 cm to insure complete covering of the photo cell)..

SECTION 3
SAFETY PRECAUTIONS

CAUTION **This procedure produces X–rays. Be sure to take appropriate precautions.**

SECTION 4
PREREQUISITES

Job Card CAL 004 ”CALIBRATION OF PHOTO CELL HV MEASUREMENT AND SCALE FACTOR”.

Note: In case of error messages during this calibration, see CAL 023 ”GENERAL ERRORS DURING THE CALIBRATION” for explanations.

SECTION 5
CALIBRATION OF PHOTO CELL SENSITIVITY AS A FUNCTION OF ITS VOLTAGE

The photo cell's sensitivity to light varies as a function of its voltage. This phenomenon is exploited by the Senographe to compensate for all the different possible configurations encountered in application mode (kV etc.). The Senographe determines the needed photo cell sensitivity for a given configuration and applies the appropriate HV to photocell.

The objective here is to determine the coefficients beta and gamma that define the relationship between photo cell HV and photo cell sensitivity. A third coefficient, alpha, is always equal to zero.

DEFAULT PARAMETER VALUES ARE ALPHA = +0.000E+0 (0), BETA = +7.377E+0 (7.377) AND GAMMA = –4.931E+1 (–49.31).

5.1 Prepare the Senographe for this calibration procedure.

1. Starting from application mode, change the position of the installation menu enable switch (switch 8 of B1 on 300PL4 CPU board, see "Accessing the Different Installation Menus in the Tree Structure" in Chapter 1).

Note: This must only be done if the Senographe has been switched off since the last access to **SETUP/INSTAL**

Note: To access to the installation menus you can select the "PASSWD" key and compose the password (given at the training course). And press the "SETUP" key.

2. Set up the Senographe in the following configuration:

- 6 cm of plexiglass.
- Paddle installed.
- Grid installed (bucky).
- No cassette.
- The Photo Cell position must be selected as follows:
  – in **position 1** (towards the patient) for software less or equal to V2.21.
  – in **position 2** for software higher or equal to V2.31.

Note: To insure that the photo cell is fully covered by the plexiglass, be sure that it overlaps the front edge of the cassette holder by about 1 cm.

CALIBRATION OF PHOTO CELL SENSITIVITY AS A FUNCTION OF ITS VOLTAGE Job Card CAL 005

3. Initialisation of heater current.
   a. Set up the following sequence:
      – Mode: 2 points
      – Focal spot: **LARGE**
      – Filter: **MO**
      – 28 kV
      – 100 mAs
   b. Take the exposure.

5.2 Perform the calibration procedure

1. Starting from application mode, select **SETUP/INSTAL/AOP/CELL/ PM/HV /CALIB** on the console.
2. Press the 2nd trigger button and hold it down. A series of X–ray exposures is taken. If more, or less, plexiglass is needed to successfully perform the calibration, the message ”not enough plex” or ”too much plexi” appears on the console display, and the series of exposures is halted.

   If this happens:
   - Release the 2nd trigger button and, according to the message, either add or remove 1 cm of plexiglass.
   - Select **SETUP/CALIB** on the console.
   - Press the 2nd trigger button and hold it down again.(a series of exposures will be taken, 5 for 700T and 10 for 800T)
3. When the calibration is successful and complete, the series of X–ray exposures halts automatically and the message ”calibration end” appears on the console display. At this point, release the 2nd trigger button.
4. Select **SETUP/PARAM** on the console. Note down the calculated values of parameters beta and gamma. Each of these values is displayed by rotating the kV dial on the console. Since the first parameter, alpha, always has a value of zero, it is not necessary to note it down.

Note: The value of alpha MUST be zero. Do not modify it under any circumstances.

5. Perform a ”CKSUM” and return to application mode. If you’re turning the machine back over to the user at this point, switch the Senographe off, then on again.

CALIBRATION OF PHOTO CELL SENSITIVITY AS A FUNCTION OF ITS VOLTAGE Job Card CAL 005 4 of 4

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Senographe 700T and 800T — Job Card CAL 006

Purpose: **SCREEN PAIR SELECTION AND CONFIGURATION**	Version No.: A Date: Dec. 18, 1995
Time: 5 min	Personnel: 1

SECTION 1
SUPPLIES

None.

SECTION 2
TOOLS

None.

SECTION 3
SAFETY PRECAUTIONS

CAUTION

NEVER leave the Senographe unattended during calibration of a screen pair unless the screen pair is disabled.

SECTION 4
PREREQUISITES

Note: In case of error messages during this calibration, see CAL 023 ”GENERAL ERRORS DURING THE CALIBRATION” for explanations.

SECTION 5
SCREEN PAIR SELECTION AND CONFIGURATION

The objective is to select and configure a screen pair prior to performing AEC calibrations on it.

5.1 Prepare the Senographe for this procedure

Starting from application mode, change the position of the installation menu enable switch (switch 8 of B1 on 300PL4 CPU board, see ”Accessing the Different Installation Menus in the Tree Structure” in Chapter 1).

Note: This must only be done if the Senographe has been switched off since the last access to **SETUP/INSTAL**

Note: To access to the installation menus you can select the ”PASSWD” key and compose the password (given at the training course). And press the ”SETUP” key.

CALIBRATION

5.2 Choose the screen pair to be configured and calibrated

Starting from application mode, select **SETUP/INSTAL/AOP/ALGO/FSC=*x*** on the console, where *x* is the screen pair indicator (A,B,C,D or E) corresponding to one of the 5 possible screen pairs to be calibrated.

Note: Do not confuse the screen pair indicator with the screen pair name, which is chosen via the procedure in section 5.5. While the 5 screen pair indicators cannot be changed and do not appear in application mode, each of them can be assigned a screen pair name corresponding to the film/cassette combination used, which appears on the console display in application AOP (0–point) and AEC (1–point) modes.

5.3 Choose screen type

Screen type would be chosen by selecting **TYPE** on the console (one, two or no screen). However, the present version of the Senographe doesn't provide any options for screen type. If you select **TYPE**, be sure to select **SETUP** before proceeding to the next section.

5.4 Choose default AOP strategy

Select **STRAT/MEDIUM** on the console.

Note: This default AOP strategy value will be verified and changed, if necessary, at the end of screen pair calibration. This value has no effect on screen pair calibration.

5.5 Choose screen pair name

Select **SETUP/NAME** on the console. Enter and validate the desired screen pair name, which can contain up to 7 characters (A to Z, 0 to 9, and colon ":"). See "Entry of an Alpha–Numeric Value" in chapter 1 for information on entering alpha–numeric values.

This is the name that will appear on the console display in application AOP (0–point) and AEC (1–point) modes.

Note: The default screen pair name is the screen pair indicator. See Section 5.2.

Typically, this name is an abbreviation of the film and cassette type used to constitute the screen pair being used. It may be a good idea at this point to ask the doctor for suggestions on choosing the screen pair name.

Note: This name can be changed at any time in the future without producing the need to re–perform any calibrations on the screen pair in question.

5.6 Enable/disable screen pair

Select **SETUP/VALID** on the console. This function makes it possible to enable or disable use of the screen pair in application. Select **NO** to disable and **YES** to enable the screen pair. SEE CAUTION in Section 3 above.

5.7 Proceed to the screen pair calibration procedures.

Once you have completed the procedures in this Job Card, perform a CKSUM, return to application mode and proceed directly to Job Card CAL 007, ”CALIBRATION OF PHOTOMULTIPLIER CELL GAIN FOR A GIVEN SCREEN PAIR”.

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Purpose: **CALIBRATION OF PHOTOMULTIPLIER CELL GAIN FOR A GIVEN SCREEN PAIR**	Version No.: A Date: April 4, 2001
Time: x h xx min	Personnel:

Note: **This procedure applies to the Senographes equiped with the “CAL007 6–parameter software”, i.e., a software version lower or equal to V2.21.**

SECTION 1
SUPPLIES

- Normal cassette of type used in the screen pair being calibrated.
- Film of type used in the screen pair being calibrated.

SECTION 2
TOOLS

- Screen–less cassette simulation tool OR cassette of type used in the screen pair being calibrated, but **without its screen** (see Section 5.3).
- Plexiglass in thickness increments of 1 cm (minimum plexiglass dimensions 20 x 20 cm to insure complete covering of the photo cell)
  Tool reference : 45 203 014 or 46–286893 P1 (US pole)

  Thickness accuracy of plexiglass plates is mandatory !

SECTION 3
SAFETY PRECAUTIONS

CAUTION

NEVER leave the Senographe unattended during calibration of a screen pair unless the screen pair is disabled.

CAUTION

These procedures produce X–rays. Be sure to take appropriate precautions.

SECTION 4
PREREQUISITES

- Job Card IST 006 ”SCREEN PAIR SELECTION AND CONFIGURATION”.
- About checksum, see Chapter 1, parag. 3–7.
- **kV accuracy check (if applicable) followed by kVp recalibration must be performed before this job card (see IST 009, parag 13.).**

Note: In case of error messages during this calibration, see CAL 023 ”GENERAL ERRORS DURING THE CALIBRATION” for explanations.

SECTION 5
ADVANCE PREPARATION AND INFORMATION

IT IS ESSENTIAL TO READ AND UNDERSTAND THIS SECTION BEFORE PROCEEDING TO ANY OF THE CALIBRATION PROCEDURES.

5.1 Know when to perform this calibration.

- <u>IF</u> this is the first screen / film combination, or
- <u>IF</u> you have replaced a photocell, or just recalibrated IST 004 or IST 005,

  Then go to Section 5.3,
- <u>IF</u> you are calibrating a new screen,

  Then do the copy procedure ”without screen” step 2. to 7. in Section 5.2.
  Then perform calibrations ”with screen”, section 6.5, 6.6, 6.7, 6.10 and 6.11.
- <u>IF</u> you are calibrating the same screen, but with a different film,

  Then do the **Copy Procedure** only Section 5.2.

CAUTION

Perform this procedure VERY CAREFULLY and EXACTLY as given below. Failure to copy the parameters correctly could ruin the calibration of existing calibrated screen pairs.

5.2 Copy Procedure

Note: Only perform this Section if you already have calibrated CAL 007 for at least one cassette previously, otherwise start at Section 5.3.

1. Perform Job Card CAL 006 ”SCREEN PAIR SELECTION AND CONFIGURATION”.
2. Starting from application mode, change the position of the installation menu enable switch (switch 8 of B1 on 300PL4 CPU board, see ”Accessing the Different Installation Menus in the Tree Structure” in Chapter 1).

Note: This must only be done if the Senographe has been switched off since the last access to **SETUP/INSTAL**

Note: To access to the installation menus you can select the ”PASSWD” key and compose the password (given at the training course). And press the ”SETUP” key.

3. Starting from application mode, select **SETUP/INSTAL/AOP/COPY/SOURCE/SCREEN/NO** on the console.
4. Select **SETUP/FSC/FSC=*x***, where *x* is the screen pair indicator corresponding to an existing calibrated screen pair using the same cassette as the screen pair currently being calibrated.
5. Select **SETUP/SETUP/TARG/SCREEN/NO**.

6. Select **SETUP/FSC/FSC=*y*** , where *y* is the indicator of the screen pair being calibrated.

Note: To access to the installation menus you can select the ”PASSWD” key and compose the password (given at the training course). And press the ”SETUP” key.

7. Once you are SURE that the screen pair indicator *y* is correct, copy the ”without screen” parameters by selecting **SETUP/SETUP/COPY/VALID**. The message ”COPY EXECUTED” appears on the console display.
8. Select **SETUP/SOURCE/SCREEN/YES** on the console.
9. Select **SETUP/FSC/FSC=*x***, where *x* is the screen pair indicator corresponding to an existing calibrated screen pair using the same cassette as the screen pair currently being calibrated.
10. Select **SETUP/SETUP/TARG/SCREEN/YES**
11. Select **SETUP/FSC/FSC=*y***, where *y* is the indicator of the screen pair being calibrated.
12. Once you are SURE that the screen pair indicator *y* is correct, copy the ”with screen” parameters by selecting **SETUP/SETUP/COPY/VALID**. The message ”COPY EXECUTED” appears on the console display.
13. STOP HERE and proceed to the next AEC calibration Job Card.

5.3 Information about cassettes and films used in these procedures

1. Determine whether or not the screen–less cassette simulation tool can be used.

   The screen–less simulation tool can be used IF AND ONLY IF THE CASSETTE OF THE SCREEN PAIR BEING CALIBRATED IS AMONG THE FOLLOWING:

   - KODAK Min–R 2.
   - FUJI MA.
   - AGFA–GEVAERT MAMORAY.
   - 3M.
   - DUPONT.
   - KONICA.

   If the cassette of the screen pair being installed is NOT among these models, the screen–less cassette simulation tool CANNOT BE USED. In this case, a normal cassette of the type used in the screen pair being calibrated must be used, but **without its screen**.

Note: If a screen–less cassette simulation tool is not available, any of the cassette models listed above, without its screen*, can be used during calibration of any screen pair that uses ANY of the models IN THE LIST. For example, if you're calibrating a screen pair that uses the 3M cassette, you can use a KODAK Min–R 2 cassette without its screen. BUT, if you are calibrating a screen pair that uses a cassette model that is not on this list, you must use a cassette of that exact model, without its screen.

* When removing the screen from a cassette, be sure to leave the layer of plastic foam intact in the cassette.

2. Learn how to use the screen–less cassette simulation tool.

   If used, the screen–less cassette simulation tool must always be loaded with an UNDEVELOPED film of the type used in the screen pair being calibrated, as shown in Illustration 1.

Note: It is normal for the film not to lie flat at the rear edge of the film holding area. The rear edge of the film holding area was in fact designed to insure that the FRONT edge of the film butts up perfectly against the front edge of the film holding area. This is critical, because the photo cell is located towards the front edge of the bucky and must be maximally covered by the film.

The loaded screen–less cassette simulation tool must be installed in the Senographe cassette holder in the same way as an ordinary cassette.

CAUTION

Be sure to orient the simulation tool in the cassette holder with its front edge coinciding with the front edge of the bucky, as shown in illustration 1.

Note: Whenever the instructions in this Job Card instruct you to ”install the loaded cassette (without screen)”, install the loaded simulation tool instead, if permitted (see step 1. in Section 5.3 above).

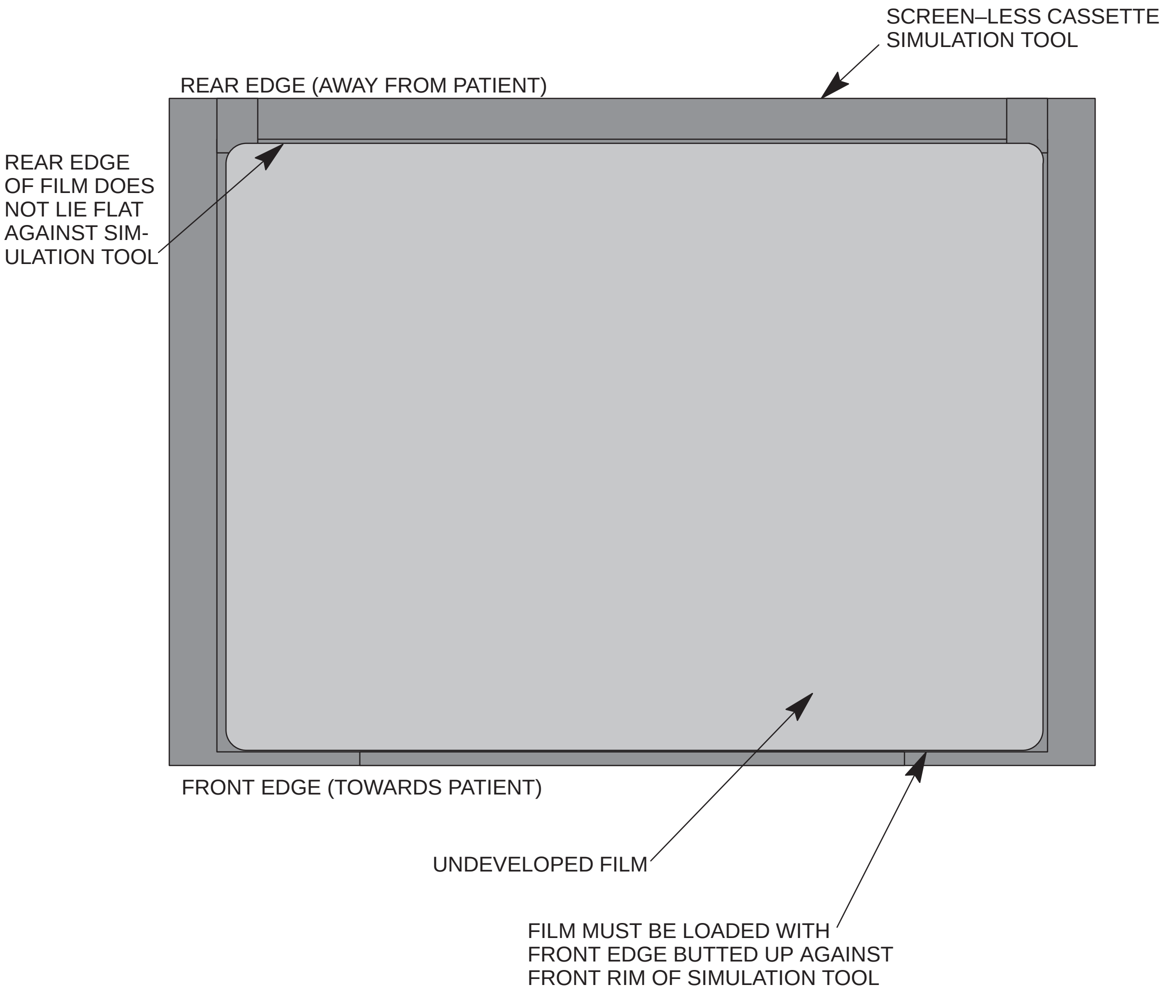
3. Each of the two cassettes (with and without screen) used in these procedures must be loaded with undeveloped film of the type used in the screen pair being calibrated.

   - The SAME two cassettes must be used for ALL procedures in this Job Card.
   - The same undeveloped films can be left in the cassettes for all procedures in this Job Card.
   - Mark the cassette without screen clearly so as not to confuse it with the cassette with screen (not applicable if screen–less cassette simulation tool is used).

5.4 Advance preparation if a new screen pair is being introduced

Select and configure a screen pair. See Job Card CAL 006 ”SCREEN PAIR SELECTION AND CONFIGURATION”.

ILLUSTRATION 1
SCREEN–LESS CASSETTE SIMULATION TOOL



Note: Loaded screen–less cassette simulation tool must be installed in the cassette holder of the Senographe, oriented as shown.

5.5 General instructions to be observed during all procedures in this Job Card

1. The photo cell must be in its most forward position (towards the patient) throughout the procedures in this Job Card.

Note: **Number the plates from 1 to 6 cm and always use the same plates for the same thickness.**

2. When selecting plexiglass thicknesses (2, 4 or 6 cm) in the menus between exposure sequences, NEVER go up in the menu structure higher than indicated in the procedure being performed. Doing so will reset stored intermediate values and ruin the calibration. Also, once all three thicknesses have been calibrated, follow the instructions immediately for performing the calculation. Select **SETUP** no more than the precise number of times indicated, again at the risk of losing intermediate values prior to the calculation.
3. On the other hand, if an error is made during the calibration of one of the three plexiglass thicknesses (for example, the plexiglass was incorrectly placed or is not the correct thickness), you MUST go upward in the menus (by selecting **SETUP** a certain number of times) at least to the level that gives the choices GRID, SCREEN and CALIB (just below PM_YLD). Here you reset the intermediate values intentionally, and you MUST repeat ALL THREE thickness calibrations.
4. Normally, this Job Card is used when a new screen pair is being introduced. In this case, follow the procedures in this Job Card in the exact order shown.
5. If, however, only part of the photo cell gain calibration is being done (e.g. because of a mistake during a certain part of the calibration), the procedures can be performed independently of the others, but be sure to read and carry out all preliminary preparations and procedures associated with the procedure in question.
6. When placing plexiglass on the cassette holder or 1.5 magnification device, the plexiglass must always overlap the front edge (towards the patient) by about 1 cm to insure that the photo cell is fully covered.
7. When taking a series of calibration exposures, if arcing occurs, the ”arcing” message appears on the console display. This does not mean that the series must be repeated (i.e. the software keeps track of which exposures in the series were successful even if it must repeat one due to arcing). Only if there were a serious arcing problem would the software abort the series, in which case it would have to be repeated.
8. When taking a series of calibration exposures, it is normal for exposures to be taken even thought the exposure counter or the console display does not increment.
9. If you are in the middle of CAL 007, and must stop, continue at another time, there are certain steps that may not be repeated.
   - If you have completed step 14. in Section 6.4, then you can start with Section 6.5.
   - If you have completed step 15. in Section 6.4, then you can start with Section 6.7.
   - If you have completed step 14. in Section 6.9, then you can start with Section 6.10.

CALIBRATION OF PHOTOMULTIPLIER CELL GAIN FOR A GIVEN SCREEN PAIR Job Card CAL 007A

SECTION 6
CALIBRATION OF PHOTO CELL GAIN

The objective is to determine the x–ray absorption of the screen. The calibration software achieves this by subtracting the photo cell gain obtained with a screen from the photo cell gain obtained without a screen.

Therefore, each configuration must be calibrated twice – once with and once without a screen.

For a 800T: 6 coefficients are calculated for each of 2 track/filter combinations. Thus, 12 coefficients are calculated for each of 4 different cases (2 configurations, each calibrated once with and once without a screen), for a total of 48 coefficients.

For a 700T: 6 coefficients are calculated for the track/filter combination. Thus, 6 coefficients are calculated for each of 4 different cases (2 configurations, each calibrated once with and once without a screen), for a total of 24 coefficients.

6.1 Prepare the Senographe for these procedures

1. Starting from application mode, change the position of the installation menu enable switch (switch 8 of B1 on 300PL4 CPU board, see ”Accessing the Different Installation Menus in the Tree Structure” in Chapter 1).

Note: This must only be done if the Senographe has been switched off since the last access to **SETUP/INSTAL**

Note: To access to the installation menus you can select the ”PASSWD” key and compose the password (given at the training course). And press the ”SETUP” key.

6.2 Prepare the Senographe for the procedures using contact mode with grid

1. Set up the Senographe in the following configuration:
   - 18 x 24 cm compression paddle installed.
   - Contact (no magnification).
   - Bucky 18x24.

Note: To avoid the ”change” of cassette after each exposure, starting from application mode, select **SETUP/MEDICAL/ 1–>2 /CASSETTE/NO** (use only for the check).

2. Perform CAL 003 ”CALIBRATION OF X–RAY TUBE HEATER CURRENT” for Large Focus only in order to have the heater current in function of the tube thermal state.

WARNING

DON’T INTERRUPT THE CAL 007 CALIBRATION DURING TOO MANY TIME (> 30 min) BECAUSE THE TUBE THERMAL STATE CHANGES AND HEATER CURRENT IS NO MORE CORRECT.

CALIBRATION

3. Starting from application mode, select **SETUP/INSTAL/AOP/ALGO/FSC=*x*** on the console, where *x* is the screen pair indicator (A,B,C,D,E) corresponding to the screen pair being calibrated. See Job Card CAL 006 ”SCREEN PAIR SELECTION AND CONFIGURATION”.

6.3 Perform the procedure using contact mode with grid and cassette without screen.

1. Be sure to be familiar with the advance preparation and information given in Section 5 before proceeding, especially the information concerning the use, if permitted, of the screen–less cassette simulation tool. Also, be sure to prepare the Senographe by following Sections 6.1 and 6.2 before proceeding.
2. Select **CALIB/PM_yld/SCREEN/NO** on the console. This sets up the calibration for the ”cassette without screen” procedure.
3. Install the loaded cassette (without screen).

WARNING

BE *VERY* SURE THAT THE CASSETTE *WITHOUT* SCREEN IS INSTALLED BECAUSE THE CHECK IN SECTION 6.4 WILL NOT SHOW AN ERROR DUE TO A MISTAKE HERE.

4. Put 2 cm of plexiglass on the bucky.
5. Lower the compression paddle onto the plexiglass.
6. Select **SETUP/CALIB/CALIB/THICK/2 cm** on the console. This ”tells” the software the amount of plexiglass present.
7. Select **SETUP/CALIB** on the console.
8. Press the 2nd trigger button and hold it down. A series of X–ray exposures is taken (700T at least 5 and 800T at least 10).
9. When the series of exposures is complete, the message ”thick calib end” appears on the console display. At this point, release the 2nd trigger button.
10. Raise the compression paddle and increase the amount of plexiglass to 4 cm.
    Select **SETUP/THICK/4 cm** on the console.
11. Lower the compression paddle onto the plexiglass. Repeat septs 7. to 9. in Section 6.3.
12. Raise the compression paddle and increase the amount of plexiglass to 6 cm.
    Select **SETUP/THICK/6 cm** on the console.
13. Lower the compression paddle onto the plexiglass. Repeat septs 7. to 9. in Section 6.3.
14. Select **SETUP/CALC/VALID** on the console. This executes the calculation of the 6 coefficients (A0, A1, A2, B0, B1, and B2) for each of 2 track/filter combinations for a 800T, and for the track/filter combination for a 700T. The message ”PM_yld cal end” appears on the console display.
15. Proceed immediately to Section 6.4 to check calibration accuracy.

6.4 Check the ”contact mode with grid and cassette without screen” calibration accuracy.

Note: This check must always be made immediately after performing the calibration procedure in Section 6.3.

1. Copy the **”without screen”** parameters for the screen pair being calibrated to the **”with screen”** parameter location of an unused screen pair by following this procedure:
   - Starting from application mode, select **SETUP/INSTAL/AOP/COPY/SOURCE/SCREEN/NO** on the console.
   - Select **SETUP/FSC/FSC=*x***, where *x* is the screen pair indicator corresponding to the screen pair being calibrated.
   - Select **SETUP/SETUP/TARG/SCREEN/YES**.
   - Select **SETUP/FSC/FSC=*y***, where *y* is the indicator of the unused screen pair (for example E).

CAUTION

Be very sure of the choice of unused screen pair indicator *y* (A, B, C, D or E). If a mistake is made, there is a risk of erasing good parameter values on another screen pair that is in use.

   - Once you are SURE that the screen pair indicator *y* is correct (see CAUTION above), copy the parameters by selecting **SETUP/SETUP/COPY/VALID**. The message ”COPY EXECUTED” appears on the console display.

2. If necessary, enable use of the unused screen pair. (From application mode, select **SETUP/INSTAL/AOP/ALGO/FSC=*y*/VALID/YES** on the console.)

Note: A checksum som error is normal when going into application mode at this point.

3. Enable visual display of parameter values when in application mode. See ”Display of Parameters Following an Exposure” in Chapter 1, Section 3–10–3.
4. Perform a ”CKSUM” and go to application mode.
5. Set up the Senographe in the configuration given, in step 1. in Section 6.2.
6. Install the loaded cassette (without screen).
7. Put 6 cm of plexiglass on the bucky.
8. Lower the compression paddle onto the plexiglass.

9. Set up the following exposure:
   - Mode: AEC (1–point)
   - Screen pair: ***y*** (this is the indicator of the unused screen pair chosen in step 1. Section 6.4)
   - Focal spot: **LARGE**
   - Filter: **MO**
   - 30 kV

Note: It may be useful to turn off automatic Decompression at NO.(from application select **SETUP/MEDICAL/DECOMP/NO** and then return to application mode).

10. Take a short exposure. It is not necessary for exposure to be complete, so the 2 nd trigger button can be released as soon as X–rays are being produced.

Note: Even if exposure is aborted due to insufficient available mAs, the thickness displayed on the console is useable. Only if kV Waveform is correctly adjusted it is NOT USEFUL to wait for the tube to cool and repeat the exposure.

11. Note down the thickness displayed on the console after the exposure. It must be equal to the plexiglass thickness ±3 mm.
12. If the Senographe is a ”800T”, select the RH filter. Repeat steps 10. to 11. in Section 6.4.
13. Repeat steps 8. to 12. in Section 6.4. using 4 cm and 2 cm of plexiglass.
14. If the displayed thickness is outside the tolerance given step 11. in Section 6.4. , first check that the correct screen pair was selected step 9. in Section 6.4 Otherwise, the corresponding calibration procedure (contact mode with grid and cassette without screen, Section 6.3) was probably done incorrectly. That procedure, as well as this check procedure immediately following it, would have to be repeated (this can be done independently of the other procedures in this Job Card).

6.5 Perform the procedure using contact mode with grid and cassette with screen.

1. Be sure to be familiar with the advance preparation and information given in Section 5 before proceeding. Also, be sure to prepare the Senographe by following Sections 6.1 and 6.2 before proceeding.
2. Starting from application mode, select **SETUP/INSTAL/AOP/ALGO/FSC=*x*/CALIB/PM_yld** on the console, where *x* is the screen pair being calibrated. This sets up the calibration for the ”cassette with screen” procedure.
3. Install the loaded cassette (with screen).

WARNING

BE *VERY* SURE THAT THE CASSETTE *WITH* SCREEN IS INSTALLED BECAUSE THE CHECK IN SECTION 6.6 WILL NOT SHOW AN ERROR DUE TO A MISTAKE HERE.

4. Put 2 cm of plexiglass on the bucky.
5. Lower the compression paddle onto the plexiglass.
6. Select **CALIB/CALIB/THICK/2 cm** on the console. This ”tells” the software the amount of plexiglass present.
7. Select **SETUP/CALIB** on the console.
8. Press the 2nd trigger button and hold it down. A series of x–ray exposures is taken (700T at least 5 and 800T at least 10).
9. When the series of exposures is complete, the message ”thick calib end” appears on the console display. At this point, release the 2nd trigger button.
10. Raise the compression paddle and increase the amount of plexiglass to 4 cm.
    Select **SETUP/THICK/4 cm** on the console.
11. Lower the compression paddle onto the plexiglass. Repeat steps 7. to 9. in Section 6.5.
12. Raise the compression paddle and increase the amount of plexiglass to 6 cm.
    Select **SETUP/THICK/6 cm** on the console.
13. Lower the compression paddle onto the plexiglass. Repeat steps 7. to 9. in Section 6.5..
14. Select **SETUP/CALC/VALID** on the console. This executes the calculation of the 6 coefficients (A0, A1, A2, B0, B1, and B2) for each of 2 track/filter combinations for a 800T, for the track/filter combination for a 700T. The message ”PM_yld cal end” appears on the console display.
15. Perform a ”CKSUM” and return to application mode.
16. Proceed immediately to Section 6.6 to check calibration accuracy.

6.6 Check the ”contact mode with grid and cassette with screen” calibration accuracy.

Note: This check must always be made immediately after performing the calibration procedure in Section 6.5.

1. If necessary enable visual display of parameter values when in application mode. ”Display of Parameters Following an Exposure” in Chapter 1, Section 3–10–2.
2. If necessary, enable use of the screen pair being calibrated. (From application mode, select **SETUP/INSTAL/AOP/ALGO/FSC=*x*/VALID/YES** on the console.)
3. Perform a ”CKSUM” and go to application mode.
4. Select the screen pair being calibrated and verify that its name is as entered in Job Card CAL 006 ”SCREEN PAIR SELECTION AND CONFIGURATION”.
5. Set up the Senographe in the configuration given step 1. in Section 6.2.
6. Install the loaded cassette (with screen).
7. Put 6 cm of plexiglass on the cassette holder.
8. Lower the compression paddle onto the plexiglass.
9. Select the MO filter .
10. Set up the following exposure:
    - Mode: AEC (1–point)
    - **Screen pair: Select the name of the screen pair being calibrated**
    - Focal spot: **LARGE**
    - 30 kV
11. Take a short exposure. It is not necessary for the exposure to be complete, so the 2nd trigger button can be released as soon as X–rays are being produced.

Note: Even if exposure is aborted due to insufficient available mAs, the thickness displayed on the console is useable. Only if kV wave form is correctly calibrated. It is NOT USEFUL to wait for the tube to cool and repeat the exposure.

12. Note down the thickness displayed on the console after the exposure. It must be equal to the plexiglass thickness ±3 mm.
13. If the Senographe is ”800T”, select the RH filter. Repeat steps 11. to 12. in Section 6.6.
14. Repeat steps 8. to 13. in Section 6.6, using 4 cm and 2 cm of plexiglass.

CALIBRATION

15. If the displayed thickness is outside the tolerance given in step 12. in Section 6.6, first check that the correct screen pair was selected in section 10. in Section 6.6. Otherwise, the corresponding calibration procedure (contact mode with grid and cassette with screen, Section 6.5) was probably done incorrectly. That procedure, as well as this check procedure immediately following it, would have to be repeated (this can be done independently of the other procedures in this Job Card).

6.7 Prepare the Senographe for the procedures using 1.5 magnification mode without grid.

Set up the Senographe in the following configuration:

- 18 x 24 cm compression paddle installed.
- 1.5 magnification device installed.
- Cassette holder.

6.8 Perform the procedure using 1.5 magnification mode without grid and cassette without screen.

1. Be sure to be familiar with the advance preparation and information given in Section 5 before proceeding, especially the information concerning the use, if permitted, of the screen–less cassette simulation tool. Also, be sure to prepare the Senographe by following Sections 6.1 and 6.7 before proceeding.
2. Starting from application mode, select **SETUP/INSTAL/AOP/ALGO/FSC=*x*** on the console, where *x* is the screen pair indicator (A, B, C, D, E) corresponding to the screen pair being calibrated.

   See Job Card CAL 006 ”SCREEN PAIR SELECTION AND CONFIGURATION”.
3. Select **CALIB/PM_YLD/GRID/NO** on the console. This sets up the calibration for the ”without grid” procedure.
4. Select **SETUP/SCREEN/NO** on the console. This sets up the calibration for the ”cassette without screen” procedure.
5. Install the loaded cassette (without screen).

WARNING

BE *VERY* SURE THAT THE CASSETTE *WITHOUT* SCREEN IS INSTALLED BECAUSE THE CHECK IN SECTION 6.9 WILL NOT SHOW AN ERROR DUE TO A MISTAKE HERE.

6. Put 2 cm of plexiglass on the 1.5 magnification device.
7. Lower the compression paddle onto the plexiglass.

CALIBRATION

8. Select **SETUP/CALIB/CALIB/THICK/2 cm** on the console. This ”tells” the software the amount of plexiglass present.
9. Select **SETUP/CALIB** on the console.
10. Press the 2nd trigger button and hold it down. A series of x–ray exposures is taken (700T at least 5, 800T at least 10).
11. When the series of exposures is complete, the message ”thick calib end” appears on the console display. At this point, release the 2nd trigger button.
12. Raise the compression paddle and increase the amount of plexiglass to 4 cm.
 Select **SETUP/THICK/4 cm** on the console.
13. Lower the compression paddle onto the plexiglass. Repeat steps 9. to 11. in Section 6.8.
14. Raise the compression paddle and increase the amount of plexiglass to 6 cm.
 Select **SETUP/THICK/6 cm** on the console.
15. Lower the compression paddle onto the plexiglass. Repeat steps 9. to 11. in Section 6.8.
16. Select **SETUP/CALC/VALID** on the console. This executes the calculation of the 6 coefficients (A0, A1, A2, B0, B1, and B2) for each of 2 track/filter combinations. The message ”PM_yld cal end” appears on the console display.
17. Perform a ”CKSUM” and return to application mode.
18. Proceed immediately to Section 6.9 to check calibration accuracy.

6.9 Check the ”1.5 magnification mode without grid and cassette without screen” calibration accuracy.

Note: This check must always be made immediately after performing the calibration procedure in Section 6.8.

1. Copy the **”without screen”** parameters for the screen pair being calibrated to the **”with screen”** parameter location of an unused screen pair by following this procedure:
   - Starting from application mode, select **SETUP/INSTAL/AOP/COPY/SOURCE/SCREEN/NO** on the console.
   - Select **SETUP/FSC/FSC=*x***, where *x* is the screen pair indicator corresponding to the screen pair being calibrated.
   - Select **SETUP/SETUP/TARG/SCREEN/YES**.
   - Select **SETUP/FSC/FSC=*y***, where *y* is the indicator of the unused screen pair.

CALIBRATION

CAUTION

Be very sure of the choice of unused screen pair indicator *y* (A, B, C, D or E). If a mistake is made, there is a risk of erasing good parameter values on another screen pair that is in use.

– Once you are SURE that the screen pair indicator *y* is correct (see CAUTION above), copy the parameters by selecting **SETUP/SETUP/COPY/VALID**. The message ”COPY EXECUTED” appears on the console display.

2. Enable visual display of parameter values when in application mode. See ”Display of Parameters Following an Exposure” in Chapter 1, Section 3–10–2”.
3. Perform a ”CKSUM” and go to application mode.
4. Set up the Senographe in the configuration given in Section 6.7.
5. Install the loaded cassette (without screen).
6. Put 6 cm of plexiglass on the 1.5 magnification device.
7. Lower the compression paddle onto the plexiglass.
8. Select the MO filter .
9. Set up the following exposure:
   - Mode: AEC (1–point)
   - Screen pair: ***y*** (this is the indicator of the unused screen pair chosen in Section 1.)
   - Focal spot: **LARGE**
   - 30 kV
10. Take a short exposure. It is not necessary for the exposure to be complete, so the 2nd trigger button can be released as soon as X–rays are being produced.

Note: Even if exposure is aborted due to insufficient available mAs, the thickness displayed on the console is useable. Only if kV wave form is correctly calibrated It is NOT USEFUL to wait for the tube to cool and repeat the exposure.

11. Note down the thickness displayed on the console after the exposure. It must be equal to the plexiglass thickness ±3 mm.
12. If the Senographe is a”800T”, select the RH filter. Repeat steps 10. to 11. in Section 6.9.
13. Repeat steps 7. to 12. in Section 6.9 using 4 cm and 2 cm of plexiglass.
14. If the displayed thickness is outside the tolerance given in step 11. in Section 6.9., first check that the correct screen pair was selected in step 9. in Section 6.9. Otherwise, the corresponding calibration procedure (1.5 magnification mode without grid and cassette without screen, Section 6.8) was probably done incorrectly. That procedure, as well as this check procedure immediately following it, would have to be repeated (this can be done independently of the other procedures in this Job Card).

6.10 Perform the procedure using 1.5 magnification mode without grid and cassette with screen.

1. Be sure to be familiar with the advance preparation and information given in section 5 before proceeding. Also, be sure to prepare the Senographe by following Sections 6.1 and 6.7 before proceeding.
2. Starting from application mode, select **SETUP/INSTAL/AOP/ALGO/FSC=*x*** on the console, where *x* is the screen pair indicator (A, B, C, D, E) corresponding to the screen pair being calibrated.

See Job Card CAL 006 ”SCREEN PAIR SELECTION AND CONFIGURATION”.

3. Select **CALIB/PM_YLD/GRID/NO** on the console. This sets up the calibration for the ”without grid” procedure.
4. Install the loaded cassette (with screen).

WARNING

BE *VERY* SURE THAT THE CASSETTE *WITH* SCREEN IS INSTALLED BECAUSE THE CHECK IN SECTION 6.11 WILL NOT SHOW AN ERROR DUE TO A MISTAKE HERE.

5. Put 2 cm of plexiglass on the 1.5 magnification device.
6. Lower the compression paddle onto the plexiglass.
7. Select **SETUP/CALIB/CALIB/THICK/2 cm** on the console. This ”tells” the software the amount of plexiglass present.
8. Select **SETUP/CALIB** on the console.
9. Press the 2nd trigger button and hold it down. A series of x–ray exposures is taken (700T at least 5, 800T at least 10).
10. When the series of exposures is complete, the message ”thick calib end” appears on the console display. At this point, release the 2nd trigger button.
11. Raise the compression paddle and increase the amount of plexiglass to 4 cm.
    Select **SETUP/THICK/4 cm** on the console.
12. Lower the compression paddle onto the plexiglass. Repeat steps 8. to 10. in Section 6.10.
13. Raise the compression paddle and increase the amount of plexiglass to 6 cm.
    Select **SETUP/THICK/6 cm** on the console.
14. Lower the compression paddle onto the plexiglass. Repeat steps 8. to 10. in Sections 6.10.
15. Select **SETUP/CALC/VALID** on the console. This executes the calculation of the 6 coefficients (A0, A1, A2, B0, B1, and B2) for each of 2 track/filter combinations. The message ”PM_yld cal end” appears on the console display.
16. Perform a ”CKSUM” and return to application mode.
17. Proceed immediately to section 6.11 to check calibration accuracy.

CALIBRATION

6.11 Check the ”1.5 magnification mode without grid and cassette with screen” calibration accuracy.

Note: This check must always be made immediately after performing the calibration procedure in Section 6.10.

1. If necessary enable visual display of parameter values when in application mode. See ”Display of Parameters Following an Exposure” in Chapter 1, Section 3–10–2.
2. If necessary, enable use of the screen pair being calibrated. (From application mode, select **SETUP/INSTAL/AOP/ALGO/FSC=*x*/VALID/YES** on the console.)
3. Perform a ”CKSUM” and go to application mode.
4. Select the screen pair being calibrated and verify that its name is as entered in Job Card IST 006 ”SCREEN PAIR SELECTION AND CONFIGURATION”.
5. Set up the Senographe in the configuration given in Section 6.7.
6. Install the loaded cassette (with screen).
7. Put 6 cm of plexiglass on the 1.5 magnification device.
8. Lower the compression paddle onto the plexiglass.
9. Select the MO filter .
10. Set up the following exposure:
    - Mode: AEC (1–point)
    - Screen pair: Select the name of the screen pair being calibrated
    - Focal spot: **LARGE**
    - Filter: **MO** .
    - 30 kV
11. Take a short exposure. It is not necessary for the exposure to be complete, so the 2nd trigger button can be released as soon as x–rays are being produced.

Note: Even if exposure is aborted due to insufficient available mAs, the thickness displayed on the console is useable. Only if kV wateform is correctly adjusted it is NOT USEFUL to wait for the tube to cool and repeat the exposure.

12. Note down the thickness displayed on the console after the exposure. It must be equal to the plexiglass thickness ±3 mm.
13. If the Senographe is a ”800T”, select the RH Filter. Repeat steps 11. to 12. in Section 6.11.

CALIBRATION

14. Repeat steps 8. to 13. in Section 6.11 using 4 cm and 2 cm of plexiglass.
15. If the displayed thickness is outside the tolerance given in step 12. in Section 6.11, first check that the correct screen pair was selected in steps 10. in Section 6.11. Otherwise, the corresponding calibration procedure (1.5 magnification mode without grid and cassette with screen, Section 6.10) was probably done incorrectly. That procedure, as well as this check procedure immediately following it, would have to be repeated (this can be done independently of the other procedures in this Job Card).
16. It is ESSENTIAL to disable the UNUSED screen pair *"y"* that was used to test the "without screen" parameters. (From application mode, select **SETUP/INSTAL/AOP/ALGO/FSC=*y*/VALID/NO** on the console.)
17. If necessary, disable use of the screen pair being calibrated. (From application mode, select **SETUP/INSTAL/AOP/ALGO/FSC=*x*/VALID/NO** on the console.) (See CAUTION in Section 3.)
18. If necessary renable Automatic Decompression at end of exposure, (from Application Mode, select **SETUP/MEDICAL/DECOMP/NO** on the console)

SECTION 7
CALIBRATING THE 5th COUPLE (ONLY)

Perform this calibration only when you need to calibrate the 5th couple.

Presuming that the last free couple is E the procedure is as shown below.

1. Perform the no–screen / contact–mode calibration (similar to the procedure in Section 6.3).
2. Copy E no–screen to E with–screen and test (similar to the procedure in Section 6.4).
3. Repeat step 1. and 2. in Section 7, in magnification–mode (similar to the procedure in Section 6.8 and 6.9).
4. Perform the with–screen / contact–mode calibration and test (similar to the procedure in Section 6.5 and 6.6).
5. repeat 7.4 in magnification–mode and test (similar to the procedure in Section 6.10 and 6.11).

Note: the above method could be applied to all couples, but is more time–consuming.

Senographe 700T and 800T Job Card CAL 007B

Purpose: **CALIBRATION OF PHOTOMULTIPLIER CELL GAIN FOR A GIVEN SCREEN PAIR**	Version No.: A Date: March 12, 2001
Time: x h xx min	Personnel:

Note: **This procedure applies to the Senographes equiped with the "CAL007 9–parameter software", i.e., a software version higher or equal to V2.31.**

SECTION 1
SUPPLIES

- Normal cassette of type used in the screen pair being calibrated (same cassette for all the procedure).
- Film of type used in the screen pair being calibrated.

SECTION 2
TOOLS

- Screen–less cassette simulation tool OR cassette of type used in the screen pair being calibrated, but **without its screen** (see Section 5.3).
- Plexiglass in thickness increments of 1 cm (minimum plexiglass dimensions 20 x 20 cm to insure complete covering of the photo cell)
  Tool reference : 2 294 558 or 46–286893 P1 (US pole)

  Thickness accuracy of plexiglass plates is mandatory (10mm ± 0.2mm) !

SECTION 3
SAFETY PRECAUTIONS

CAUTION

NEVER leave the Senographe unattended during calibration of a screen pair unless the screen pair is disabled.

CAUTION

These procedures produce X–rays. Be sure to take appropriate precautions.

SECTION 4
PREREQUISITES

- Job Card CAL 006 "SCREEN PAIR SELECTION AND CONFIGURATION".
- About checksum, see Chapter 1, parag. 3–7.
- **kV accuracy check (if applicable) followed by kVp recalibration must be performed before this job card (see CAL 009, parag 13.).**

Note: In case of error messages during this calibration, see CAL 023 "GENERAL ERRORS DURING THE CALIBRATION" for explanations.

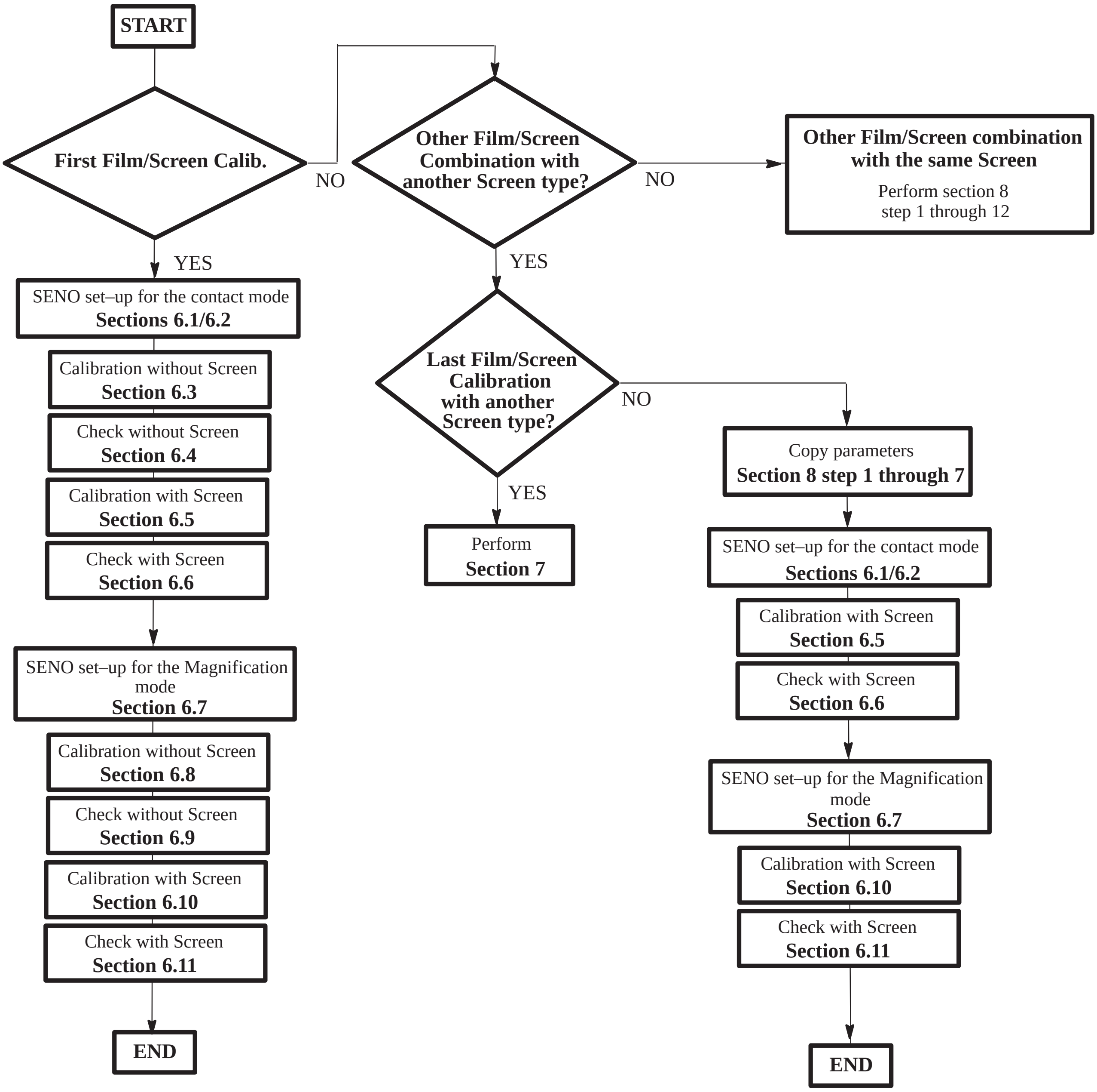
CALIBRATION OF PHOTOMULTIPLIER CELL GAIN FOR A GIVEN SCREEN PAIR

Job Card CAL 007B

SECTION 5
ADVANCE PREPARATION AND INFORMATION

5.1 Know when to perform this calibration. See illustration 1

ILLUSTRATION 1
CAL007 FLOWCHART



CALIBRATION

5.2 Information about cassettes and films used in these procedures

1. Determine whether or not the screen–less cassette simulation tool can be used.

   The screen–less simulation tool can be used IF AND ONLY IF THE CASSETTE OF THE SCREEN PAIR BEING CALIBRATED IS AMONG THE FOLLOWING:

   - KODAK Min–R 2.
   - FUJI MA.
   - AGFA–GEVAERT MAMORAY.
   - 3M.
   - DUPONT.
   - KONICA.

   If the cassette of the screen pair being installed is NOT among these models, the screen–less cassette simulation tool CANNOT BE USED. In this case, a normal cassette of the type used in the screen pair being calibrated must be used, but **without its screen**.

Note: If a screen–less cassette simulation tool is not available, any of the cassette models listed above, without its screen*, can be used during calibration of any screen pair that uses ANY of the models IN THE LIST. For example, if you're calibrating a screen pair that uses the 3M cassette, you can use a KODAK Min–R 2 cassette without its screen. BUT, if you are calibrating a screen pair that uses a cassette model that is not on this list, you must use a cassette of that exact model, without its screen.

* When removing the screen from a cassette, be sure to leave the layer of plastic foam intact in the cassette.

2. Learn how to use the screen–less cassette simulation tool.

   If used, the screen–less cassette simulation tool must always be loaded with an UNDEVELOPED film of the type used in the screen pair being calibrated, as shown in Illustration 1.

Note: It is normal for the film not to lie flat at the rear edge of the film holding area. The rear edge of the film holding area was in fact designed to insure that the FRONT edge of the film butts up perfectly against the front edge of the film holding area. This is critical, because the photo cell is located towards the front edge of the bucky and must be maximally covered by the film.

The loaded screen–less cassette simulation tool must be installed in the Senographe cassette holder or in the bucky in the same way as an ordinary cassette.

CAUTION

Be sure to orient the simulation tool in the cassette holder with its front edge coinciding with the front edge of the bucky, as shown in illustration 1.

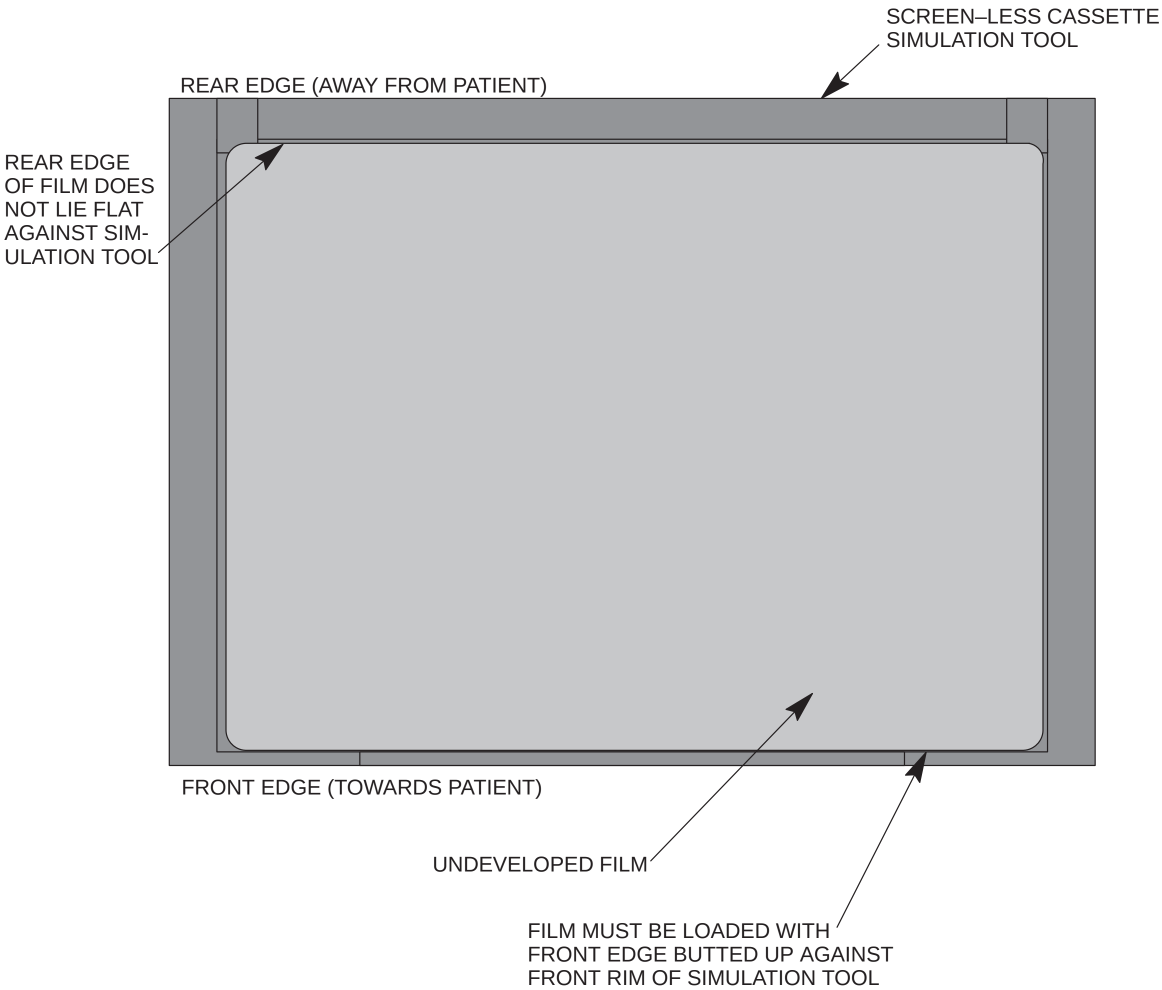
Note: Whenever the instructions in this Job Card instruct you to "install the loaded cassette (without screen)", install the loaded simulation tool instead, if permitted (see step 1. in Section 5.3 above).

3. Each of the two cassettes (with and without screen) used in these procedures must be loaded with undeveloped film of the type used in the screen pair being calibrated.
   - The SAME two cassettes must be used for ALL procedures in this Job Card.
   - The same undeveloped films can be left in the cassettes for all procedures in this Job Card.
   - Mark the cassette without screen clearly so as not to confuse it with the cassette with screen (not applicable if screen–less cassette simulation tool is used).

5.3 Advance preparation if a new screen pair is being introduced

Select and configure a screen pair. See Job Card CAL 006 "SCREEN PAIR SELECTION AND CONFIGURATION".

ILLUSTRATION 1
SCREEN–LESS CASSETTE SIMULATION TOOL



Note: Loaded screen–less cassette simulation tool must be installed in the cassette holder or in the bucky of the Senographe, oriented as shown.

5.4 General instructions to be observed during all procedures in this Job Card

1. The photo cell must be in **position 2** throughout the procedures in this Job Card.

Note: Number the plexiglass plates from 1 to 7 cm and always use the same plates for the same thickness.

2. When selecting plexiglass thicknesses (1, 3, 5 or 7 cm) in the menus between exposure sequences, NEVER go up in the menu structure higher than indicated in the procedure being performed. Doing so will reset stored intermediate values and ruin the calibration. Also, once all three thicknesses have been calibrated, follow the instructions immediately for performing the calculation. Select **SETUP** no more than the precise number of times indicated, again at the risk of losing intermediate values prior to the calculation.
3. On the other hand, if an error is made during the calibration of one of the four plexiglass thicknesses (for example, the plexiglass was incorrectly placed or is not the correct thickness), you MUST go upward in the menus (by selecting **SETUP** a certain number of times) at least to the level that gives the choices GRID, SCREEN and CALIB (just below PM_YLD). Here you reset the intermediate values intentionally, and you MUST repeat ALL FOUR thickness calibrations.
4. Normally, this Job Card is used when a new screen pair is being introduced. In this case, follow the procedures in this Job Card in the exact order shown.
5. If, however, only part of the photo cell gain calibration is being done (e.g. because of a mistake during a certain part of the calibration), the procedures can be performed independently of the others, but be sure to read and carry out all preliminary preparations and procedures associated with the procedure in question.
6. When placing plexiglass on the cassette holder or 1.5 magnification device, the plexiglass must always overlap the front edge (towards the patient) by about 1 cm to insure that the photo cell is fully covered.
7. When taking a series of calibration exposures, if arcing occurs, the ”arcing” message appears on the console display. This does not mean that the series must be repeated (i.e. the software keeps track of which exposures in the series were successful even if it must repeat one due to arcing). Only if there were a serious arcing problem would the software abort the series, in which case it would have to be repeated.
8. When taking a series of calibration exposures, it is normal for exposures to be taken even though the exposure counter or the console display does not increment.
9. If you are in the middle of CAL 007, and must stop, continue at another time, there are certain steps that need not be repeated.
   - If you have completed step 14. in Section 6.4, then you can start with Section 6.5.
   - If you have completed step 15. in Section 6.4, then you can start with Section 6.7.
   - If you have completed step 14. in Section 6.9, then you can start with Section 6.10.

SECTION 6
CALIBRATION OF PHOTO CELL GAIN

The objective is to determine the x–ray absorption of the screen. The calibration software achieves this by subtracting the photo cell gain obtained with a screen from the photo cell gain obtained without a screen.

Therefore, each configuration must be calibrated twice – once with and once without a screen.

For a 800T: 9 coefficients are calculated for each of 2 track/filter combinations. Thus, 18 coefficients are calculated for each of 4 different cases (2 configurations, each calibrated once with and once without a screen), for a total of 72 coefficients.

For a 700T: 9 coefficients are calculated for the track/filter combination. Thus, 9 coefficients are calculated for each of 4 different cases (2 configurations, each calibrated once with and once without a screen), for a total of 36 coefficients.

6.1 Prepare the Senographe for these procedures

1. Starting from application mode, change the position of the installation menu enable switch (switch 8 of B1 on 300PL4 CPU board, see ”Accessing the Different Installation Menus in the Tree Structure” in Chapter 1).

Note: This must only be done if the Senographe has been switched off since the last access to **SETUP/INSTAL**

Note: To access to the installation menus you can select the ”PASSWD” key and compose the password (given at the training course). And press the ”SETUP” key.

6.2 Prepare the Senographe for the procedures using contact mode with grid

1. Set up the Senographe in the following configuration:
   - 18 x 24 cm compression paddle installed.
   - Contact (no magnification).
   - Bucky 18x24.
   - 18 X 24 Large Focus Collimator Blade

Note: To avoid the ”change” of cassette after each exposure, starting from application mode, select **SETUP/MEDICAL/ 1–>2 /CASSETTE/NO** (use only for the check).

2. Perform CAL003 “CALIBRATION OF X–RAY TUBE HEATER CURRENT” for Large Focus only in order to have the heater current in function of the thermal state.
3. Perform the following exposures:
   Set up the Senographe in the following configuration:
   - Mo/Mo Track/Filter.
   - Manual mode.

CALIBRATION

- 100 mAs.
- 4 cm of plexiglass.

Take exposures for the following kVp values:
24, 26, 28, 30, 32 and 35 kVp.

4. Starting from application mode, select **SETUP/INSTAL/AOP/ALGO/FSC=*x*** on the console, where *x* is the screen pair indicator (A,B,C,D,E) corresponding to the screen pair being calibrated. See Job Card CAL 006 ”SCREEN PAIR SELECTION AND CONFIGURATION”.

6.3 Perform the procedure using contact mode with grid and cassette without screen.

1. Be sure to be familiar with the advance preparation and information given in Section 5 before proceeding, especially the information concerning the use, if permitted, of the screen–less cassette simulation tool. Also, be sure to prepare the Senographe by following Sections 6.1 and 6.2 before proceeding.
2. Select **CALIB/PM_yld/SCREEN/NO** on the console. This sets up the calibration for the ”cassette without screen” procedure.
3. Install the loaded cassette (without screen).

WARNING

BE *VERY* SURE THAT THE CASSETTE *WITHOUT* SCREEN IS INSTALLED BECAUSE THE CHECK IN SECTION 6.4 WILL NOT SHOW AN ERROR DUE TO A MISTAKE HERE.

4. Put 1 cm of plexiglass on the bucky.
5. Lower the compression paddle onto the plexiglass.
6. Select **SETUP/CALIB/CALIB/THICK/1 cm** on the console. This ”tells” the software the amount of plexiglass present.
7. Select **SETUP/CALIB** on the console.
8. Press the 2nd trigger button and hold it down. A series of X–ray exposures is taken:
   – for SENO 700T : 6–12 exp. with 1, 3, 5 cm, 4–8 exp. with 7 cm;
   – for SENO 800T : 12–24 exp. with 1, 3, 5 cm and 8–16 exp. with 7 cm.
9. When the series of exposures is complete, the message ”thick calib end” appears on the console display. At this point, release the 2nd trigger button.
10. Raise the compression paddle and increase the amount of plexiglass to 3 cm.
    Select **SETUP/THICK/3 cm** on the console.
11. Lower the compression paddle onto the plexiglass. Repeat septs 7. to 9. in Section 6.3.
12. Raise the compression paddle and increase the amount of plexiglass to 5 cm.
    Select **SETUP/THICK/5 cm** on the console.

13. Raise the compression paddle and increase the amount of plexiglass to 7 cm.
    Select **SETUP/THICK/7 cm** on the console.
14. Lower the compression paddle onto the plexiglass. Repeat septs 7. to 9. in Section 6.3.
15. Select **SETUP/CALC/VALID** on the console. This executes the calculation of the 9 coefficients (A0, A1, A2, B0, B1, B2, C0, C1 and C2) for each of 2 track/filter combinations for a 800T, and for the track/filter combination for a 700T. The message ”PM_yld cal end” appears on the console display.
16. Proceed immediately to Section 6.4 to check calibration accuracy.

6.4 Check the ”contact mode with grid and cassette without screen” calibration accuracy.

Note: This check must always be made immediately after performing the calibration procedure in Section 6.3.

1. Copy the **”without screen”** parameters for the screen pair being calibrated to the **”with screen”** parameter location of an unused screen pair (generally E) by following this procedure:
   - Starting from application mode, select **SETUP/INSTAL/AOP/COPY/SOURCE/SCREEN/NO** on the console, then **SETUP/FSC/FSC=*x***, where *x* is the screen pair indicator corresponding to the screen pair being calibrated.
   - Select **SETUP/SETUP/TARG/SCREEN/YES,** then **SETUP/FSC/FSC=*y***, where *y* is the indicator of the unused screen pair (for example E)

CAUTION

Be very sure of the choice of unused screen pair indicator *y* (A, B, C, D or E). If a mistake is made, there is a risk of erasing good parameter values on another screen pair that is in use.

   - Once you are SURE that the screen pair indicator *y* is correct (see CAUTION above), copy the parameters by selecting **SETUP/SETUP/COPY/VALID**. The message ”COPY EXECUTED” appears on the console display.
2. If necessary, enable use of the unused screen pair. (From application mode, select **SETUP/INSTAL/AOP/ALGO/FSC=*y*/VALID/YES** on the console.)

Note: A checksum error is normal when going into application mode at this point.

3. Enable visual display of parameter values when in application mode. See ”Display of Parameters Following an Exposure” in Chapter 1, Section 3–10–3.
4. Perform a ”CKSUM” and go to application mode.
5. Set up the Senographe in the configuration given, in step 1. in Section 6.2.
6. Install the loaded cassette (without screen).
7. Put 7 cm of plexiglass on the bucky.
8. Lower the compression paddle onto the plexiglass.

9. Set up the following exposure:
   - Mode: AEC (1–point)
   - Screen pair: ***y*** (this is the indicator of the unused screen pair chosen in step 1. Section 6.4)
   - Focal spot: **LARGE**
   - Filter: **MO**
   - 29 kV

Note: It may be useful to turn off automatic Decompression at NO (from application select **SETUP/MEDICAL/DECOMP/NO** and then return to application mode).

10. Take a short exposure. It is not necessary for exposure to be complete, so the 2 nd trigger button can be released as soon as X–rays are being produced.

Note: Even if exposure is aborted due to insufficient available mAs, the thickness displayed on the console is useable. Only if kV Waveform is correctly adjusted it is NOT USEFUL to wait for the tube to cool and repeat the exposure.

11. Note down in the Job Card IST011B (CAL007B data) the thickness displayed on the console after the exposure. It must be equal to the plexiglass thickness ± 2mm (± 1mm expected).

Note: If exposure aborts, the tolerance can be higher but must be within ± 3mm.

12. If the Senographe is a ”800T”, select the RH filter. Repeat steps 10. to 11. in Section 6.4.
13. Repeat steps 8. to 12. in Section 6.4. for the following settings: **4 cm/25 kV, 4 cm/29 kV, 4 cm/34 kV**, and **1 cm/29 kV**.
14. If the displayed thickness is outside the tolerance given step 11. in Section 6.4. , first check that the correct screen pair was selected step 9. in Section 6.4 Otherwise, the corresponding calibration procedure (contact mode with grid and cassette without screen, Section 6.3) was probably done incorrectly. That procedure, as well as this check procedure immediately following it, would have to be repeated (this can be done independently of the other procedures in this Job Card).

6.5 Perform the procedure using contact mode with grid and cassette with screen.

1. Be sure to be familiar with the advance preparation and information given in Section 5 before proceeding. Also, be sure to prepare the Senographe by following Sections 6.1 and 6.2 before proceeding.
2. Starting from application mode, select **SETUP/INSTAL/AOP/ALGO/FSC=*x*/CALIB/PM_yld** on the console, where *x* is the screen pair being calibrated. This sets up the calibration for the ”cassette with screen” procedure.
3. Install the loaded cassette (with screen).

CALIBRATION

WARNING

BE *VERY* SURE THAT THE CASSETTE *WITH* SCREEN IS INSTALLED BECAUSE THE CHECK IN SECTION 6.6 WILL NOT SHOW AN ERROR DUE TO A MISTAKE HERE.

4. Put 1 cm of plexiglass on the bucky.
5. Lower the compression paddle onto the plexiglass.
6. Select **CALIB/CALIB/THICK/1 cm** on the console. This ”tells” the software the amount of plexiglass present.
7. Select **SETUP/CALIB** on the console.
8. Press the 2nd trigger button and hold it down. A series of x–ray exposures is taken:
   – for SENO 700T : 6–12 exp. with 1, 3, 5 cm, 4–8 exp. with 7 cm;
   – for SENO 800T : 12–24 exp. with 1, 3, 5 cm and 8–16 exp. with 7 cm.
9. When the series of exposures is complete, the message ”thick calib end” appears on the console display. At this point, release the 2nd trigger button.
10. Raise the compression paddle and increase the amount of plexiglass to 3 cm.
    Select **SETUP/THICK/3 cm** on the console.
11. Lower the compression paddle onto the plexiglass. Repeat steps 7. to 9. in Section 6.5.
12. Raise the compression paddle and increase the amount of plexiglass to 5 cm.
    Select **SETUP/THICK/5 cm** on the console.
13. Lower the compression paddle onto the plexiglass. Repeat steps 7. to 9. in Section 6.5..
14. Raise the compression paddle and increase the amount of plexiglass to 7 cm.
    Select **SETUP/THICK/7 cm** on the console.
15. Lower the compression paddle onto the plexiglass. Repeat steps 7. to 9. in Section 6.5.
16. Select **SETUP/CALC/VALID** on the console. This executes the calculation of the 9 coefficients (A0, A1, A2, B0, B1, B2, C0, C1 and C2) for each of 2 track/filter combinations for a 800T, for the track/filter combination for a 700T. The message ”PM_yld cal end” appears on the console display.
17. Perform a ”CKSUM” and return to application mode.
18. Proceed immediately to Section 6.6 to check calibration accuracy.

6.6 Check the ”contact mode with grid and cassette with screen” calibration accuracy.

Note: This check must always be made immediately after performing the calibration procedure in Section 6.5.

1. If necessary enable visual display of parameter values when in application mode. ”Display of Parameters Following an Exposure” in Chapter 1, Section 3–10–2.

CALIBRATION

2. If necessary, enable use of the screen pair being calibrated. (From application mode, select **SETUP/INSTAL/AOP/ALGO/FSC=*x*/VALID/YES** on the console.)
3. Perform a ”CKSUM” and go to application mode.
4. Select the screen pair being calibrated and verify that its name is as entered in Job Card CAL 006 ”SCREEN PAIR SELECTION AND CONFIGURATION”.
5. Set up the Senographe in the configuration given step 1. in Section 6.2.
6. Install the loaded cassette (with screen).
7. Put 7 cm of plexiglass on the cassette holder.
8. Lower the compression paddle onto the plexiglass.
9. Select the MO filter .
10. Set up the following exposure:
    - Mode: AEC (1–point)
    - **Screen pair: Select the name of the screen pair being calibrated**
    - Focal spot: **LARGE**
    - 29 kV
11. Take a short exposure. It is not necessary for the exposure to be complete, so the 2nd trigger button can be released as soon as X–rays are being produced.

Note: Even if exposure is aborted due to insufficient available mAs, the thickness displayed on the console is useable. Only if kV wave form is correctly calibrated. It is NOT USEFUL to wait for the tube to cool and repeat the exposure.

12. Note down in the Job Card IST011B (CAL007B data) the thickness displayed on the console after the exposure. It must be equal to the plexiglass thickness ±2 mm (±1 mm expected).

Note: If exposure aborts, the tolerance can be higher but must be within ± 3mm.

13. If the Senographe is ”800T”, select the RH filter. Repeat steps 11. to 12. in Section 6.6.
14. Repeat steps 8. to 13. in Section 6.6, for the following settings: **4 cm/25 kV, 4 cm/29 kV, 4 cm/34 kV**, and **1 cm/29 kV**.
15. If the displayed thickness is outside the tolerance given in step 12. in Section 6.6, first check that the correct screen pair was selected in section 10. in Section 6.6. Otherwise, the corresponding calibration procedure (contact mode with grid and cassette with screen, Section 6.5) was probably done incorrectly. That procedure, as well as this check procedure immediately following it, would have to be repeated (this can be done independently of the other procedures in this Job Card).

CALIBRATION

6.7 Prepare the Senographe for the procedures using 1.5 magnification mode without grid.

Set up the Senographe in the following configuration:

- 18 x 24 cm compression paddle installed.
- 1.5 magnification device installed.
- Cassette holder.
- 18 X 24 Large Focus Collimator Blade

6.8 Perform the procedure using 1.5 magnification mode without grid and cassette without screen.

1. Be sure to be familiar with the advance preparation and information given in Section 5 before proceeding, especially the information concerning the use, if permitted, of the screen–less cassette simulation tool. Also, be sure to prepare the Senographe by following Sections 6.1 and 6.7 before proceeding.
2. Starting from application mode, select **SETUP/INSTAL/AOP/ALGO/FSC=*x*** on the console, where *x* is the screen pair indicator (A, B, C, D, E) corresponding to the screen pair being calibrated.

   See Job Card CAL 006 ”SCREEN PAIR SELECTION AND CONFIGURATION”.
3. Select **CALIB/PM_YLD/GRID/NO** on the console. This sets up the calibration for the ”without grid” procedure.
4. Select **SETUP/SCREEN/NO** on the console. This sets up the calibration for the ”cassette without screen” procedure.
5. Install the loaded cassette (without screen).

WARNING

BE *VERY* SURE THAT THE CASSETTE *WITHOUT* SCREEN IS INSTALLED BECAUSE THE CHECK IN SECTION 6.9 WILL NOT SHOW AN ERROR DUE TO A MISTAKE HERE.

6. Put 1 cm of plexiglass on the 1.5 magnification device.
7. Lower the compression paddle onto the plexiglass.

8. Select **SETUP/CALIB/CALIB/THICK/1 cm** on the console. This ”tells” the software the amount of plexiglass present.
9. Select **SETUP/CALIB** on the console.
10. Press the 2nd trigger button and hold it down. A series of x–ray exposures is taken:
– for SENO 700T : 6–12 exp. with 1, 3, 5 cm, 4–8 exp. with 7 cm;
– for SENO 800T : 12–24 exp. with 1, 3, 5 cm and 8–16 exp. with 7 cm.
11. When the series of exposures is complete, the message ”thick calib end” appears on the console display. At this point, release the 2nd trigger button.
12. Raise the compression paddle and increase the amount of plexiglass to 3 cm.
Select **SETUP/THICK/3 cm** on the console.
13. Lower the compression paddle onto the plexiglass. Repeat steps 9. to 11. in Section 6.8.
14. Raise the compression paddle and increase the amount of plexiglass to 5 cm.
Select **SETUP/THICK/5 cm** on the console.
15. Lower the compression paddle onto the plexiglass. Repeat steps 9. to 11. in Section 6.8.
16. Raise the compression paddle and increase the amount of plexiglass to 7 cm.
Select **SETUP/THICK/7 cm** on the console.
17. Lower the compression paddle onto the plexiglass. Repeat steps 9. to 11. in Section 6.8.
18. Select **SETUP/CALC/VALID** on the console. This executes the calculation of the 9 coefficients (A0, A1, A2, B0, B1, B2, C0, C1 and C2) for each of 2 track/filter combinations. The message ”PM_yld cal end” appears on the console display.
19. Perform a ”CKSUM” and return to application mode.
20. Proceed immediately to Section 6.9 to check calibration accuracy.

6.9 Check the ”1.5 magnification mode without grid and cassette without screen” calibration accuracy.

Note: This check must always be made immediately after performing the calibration procedure in Section 6.8.

1. Copy the **”without screen”** parameters for the screen pair being calibrated to the **”with screen”** parameter location of an unused screen pair (generally E) by following this procedure:
   - Starting from application mode, select **SETUP/INSTAL/AOP/COPY/SOURCE/SCREEN/NO** on the console.
   - Select **SETUP/FSC/FSC=*x***, where *x* is the screen pair indicator corresponding to the screen pair being calibrated.
   - Select **SETUP/SETUP/TARG/SCREEN/YES**.

CALIBRATION

- Select **SETUP/FSC/FSC=*y***, where *y* is the indicator of the unused screen pair.

CAUTION

Be very sure of the choice of unused screen pair indicator *y* (A, B, C, D or E). If a mistake is made, there is a risk of erasing good parameter values on another screen pair that is in use.

– Once you are SURE that the screen pair indicator *y* is correct (see CAUTION above), copy the parameters by selecting **SETUP/SETUP/COPY/VALID**. The message ”COPY EXECUTED” appears on the console display.

2. Enable visual display of parameter values when in application mode. See ”Display of Parameters Following an Exposure” in Chapter 1, Section 3–10–2”.
3. Perform a ”CKSUM” and go to application mode.
4. Set up the Senographe in the configuration given in Section 6.7.
5. Install the loaded cassette (without screen).
6. Put 7 cm of plexiglass on the 1.5 magnification device.
7. Lower the compression paddle onto the plexiglass.
8. Select the MO filter .
9. Set up the following exposure:
   - Mode: AEC (1–point)
   - Screen pair: ***y*** (this is the indicator of the unused screen pair chosen in Section 1.)
   - Focal spot: **LARGE**
   - 29 kV
10. Take a short exposure. It is not necessary for the exposure to be complete, so the 2nd trigger button can be released as soon as X–rays are being produced.

Note: Even if exposure is aborted due to insufficient available mAs, the thickness displayed on the console is useable. Only if kV wave form is correctly calibrated It is NOT USEFUL to wait for the tube to cool and repeat the exposure.

11. Note down in the Job Card IST011B (CAL007B data) the thickness displayed on the console after the exposure. It must be equal to the plexiglass thickness ±2 mm (±1 mm expected).

Note: If exposure aborts, the tolerance can be higher but must be within ± 3mm.

12. If the Senographe is a”800T”, select the RH filter. Repeat steps 10. to 11. in Section 6.9.
13. Repeat steps 7. to 12. in Section 6.9 for the following settings: **4 cm/25 kV, 4 cm/29 kV, 4 cm/34 kV**, and **1 cm/29 kV**.
14. If the displayed thickness is outside the tolerance given in step 11. in Section 6.9., first check that the correct screen pair was selected in step 9. in Section 6.9. Otherwise, the corresponding calibration procedure (1.5 magnification mode without grid and cassette without screen, Section 6.8) was probably done incorrectly. That procedure, as well as this check procedure immediately following it, would have to be repeated (this can be done independently of the other procedures in this Job Card).

6.10 Perform the procedure using 1.5 magnification mode without grid and cassette with screen.

1. Be sure to be familiar with the advance preparation and information given in section 5 before proceeding. Also, be sure to prepare the Senographe by following Sections 6.1 and 6.7 before proceeding.
2. Starting from application mode, select **SETUP/INSTAL/AOP/ALGO/FSC=*x*** on the console, where *x* is the screen pair indicator (A, B, C, D, E) corresponding to the screen pair being calibrated.

See Job Card CAL 006 ”SCREEN PAIR SELECTION AND CONFIGURATION”.

3. Select **CALIB/PM_YLD/GRID/NO** on the console. This sets up the calibration for the ”without grid” procedure.
4. Install the loaded cassette (with screen).

WARNING

BE *VERY* SURE THAT THE CASSETTE *WITH* SCREEN IS INSTALLED BECAUSE THE CHECK IN SECTION 6.11 WILL NOT SHOW AN ERROR DUE TO A MISTAKE HERE.

5. Put 1 cm of plexiglass on the 1.5 magnification device.
6. Lower the compression paddle onto the plexiglass.
7. Select **SETUP/CALIB/CALIB/THICK/1 cm** on the console. This ”tells” the software the amount of plexiglass present.
8. Select **SETUP/CALIB** on the console.
9. Press the 2nd trigger button and hold it down. A series of x–ray exposures is taken:
   – for SENO 700T : 6–12 exp. with 1, 3, 5 cm, 4–8 exp. with 7 cm;
   – for SENO 800T : 12–24 exp. with 1, 3, 5 cm and 8–16 exp. with 7 cm.
10. When the series of exposures is complete, the message ”thick calib end” appears on the console display. At this point, release the 2nd trigger button.
11. Raise the compression paddle and increase the amount of plexiglass to 3 cm.
    Select **SETUP/THICK/3 cm** on the console.
12. Lower the compression paddle onto the plexiglass. Repeat steps 8. to 10. in Section 6.10.
13. Raise the compression paddle and increase the amount of plexiglass to 5 cm.
    Select **SETUP/THICK/5 cm** on the console.
14. Lower the compression paddle onto the plexiglass. Repeat steps 8. to 10. in Sections 6.10.
15. Raise the compression paddle and increase the amount of plexiglass to 7 cm.
    Select **SETUP/THICK/7 cm** on the console.
16. Lower the compression paddle onto the plexiglass. Repeat steps 8. to 10. in Sections 6.10.

17. Select **SETUP/CALC/VALID** on the console. This executes the calculation of the 9 coefficients (A0, A1, A2, B0, B1, B2, C0, C1 and C2) for each of 2 track/filter combinations. The message ”PM_yld cal end” appears on the console display.
18. Perform a ”CKSUM” and return to application mode.
19. Proceed immediately to section 6.11 to check calibration accuracy.

6.11 Check the ”1.5 magnification mode without grid and cassette with screen” calibration accuracy.

Note: This check must always be made immediately after performing the calibration procedure in Section 6.10.

1. If necessary enable visual display of parameter values when in application mode. See ”Display of Parameters Following an Exposure” in Chapter 1, Section 3–10–2.
2. If necessary, enable use of the screen pair being calibrated. (From application mode, select **SETUP/INSTAL/AOP/ALGO/FSC=*x*/VALID/YES** on the console.)
3. Perform a ”CKSUM” and go to application mode.
4. Select the screen pair being calibrated and verify that its name is as entered in Job Card IST 006 ”SCREEN PAIR SELECTION AND CONFIGURATION”.
5. Set up the Senographe in the configuration given in Section 6.7.
6. Install the loaded cassette (with screen).
7. Put 7 cm of plexiglass on the 1.5 magnification device.
8. Lower the compression paddle onto the plexiglass.
9. Select the MO filter .
10. Set up the following exposure:
    - Mode: AEC (1–point)
    - Screen pair: Select the name of the screen pair being calibrated
    - Focal spot: **LARGE**
    - Filter: **MO** .
    - 29 kV
11. Take a short exposure. It is not necessary for the exposure to be complete, so the 2nd trigger button can be released as soon as x–rays are being produced.

Note: Even if exposure is aborted due to insufficient available mAs, the thickness displayed on the console is useable. Only if kV wateform is correctly adjusted it is NOT USEFUL to wait for the tube to cool and repeat the exposure.

CALIBRATION

12. Note down in the Job Card IST011B (CAL007B data) the thickness displayed on the console after the exposure. It must be equal to the plexiglass thickness ±2 mm (±1 mm expected).

Note: If exposure aborts, the tolerance can be higher but must be within ± 3mm.

13. If the Senographe is a ”800T”, select the RH Filter. Repeat steps 11. to 12. in Section 6.11.
14. Repeat steps 8. to 13. in Section 6.11 for the following settings: **4 cm/25 kV, 4 cm/29 kV, 4 cm/34 kV**, and **1 cm/29 kV**.
15. If the displayed thickness is outside the tolerance given in step 12. in Section 6.11, first check that the correct screen pair was selected in steps 10. in Section 6.11. Otherwise, the corresponding calibration procedure (1.5 magnification mode without grid and cassette with screen, Section 6.10) was probably done incorrectly. That procedure, as well as this check procedure immediately following it, would have to be repeated (this can be done independently of the other procedures in this Job Card).
16. It is ESSENTIAL to disable the UNUSED screen pair *”y”* that was used to test the ”without screen” parameters. (From application mode, select **SETUP/INSTAL/AOP/ALGO/FSC=*y*/VALID/NO** on the console.)
17. If necessary, disable use of the screen pair being calibrated. (From application mode, select **SETUP/INSTAL/AOP/ALGO/FSC=*x*/VALID/NO** on the console.) (See CAUTION in Section 3.)
18. If necessary renable Automatic Decompression at end of exposure, (from Application Mode, select **SETUP/MEDICAL/DECOMP/NO** on the console)

SECTION 7
CALIBRATING THE 5th COUPLE (ONLY)

Perform this calibration only when you need to calibrate the 5th couple.

Presuming that the last free couple is E the procedure is as shown below.

1. Perform the no–screen / contact–mode calibration (similar to the procedure in Section 6.3).
2. Copy E no–screen to E with–screen and test (similar to the procedure in Section 6.4).
3. Repeat step 1. and 2. in Section 7, in magnification–mode (similar to the procedure in Section 6.8 and 6.9).
4. Perform the with–screen / contact–mode calibration and test (similar to the procedure in Section 6.5 and 6.6).
5. repeat 7.4 in magnification–mode and test (similar to the procedure in Section 6.10 and 6.11).

Note: the above method could be applied to all couples, but is more time–consuming.

SECTION 8
COPY OF PARAMETERS

CAUTION

Perform this procedure VERY CAREFULLY and EXACTLY as given below. Failure to copy the parameters correctly could ruin the calibration of existing calibrated screen pairs.

8.1 Copy Procedure

Note: Only perform this Section if you already have calibrated CAL 007 for at least one cassette previously, otherwise start at Section 5.3.

1. Perform Job Card CAL 006 ”SCREEN PAIR SELECTION AND CONFIGURATION”.
2. Starting from application mode, change the position of the installation menu enable switch (switch 8 of B1 on 300PL4 CPU board, see ”Accessing the Different Installation Menus in the Tree Structure” in Chapter 1).

Note: This must only be done if the Senographe has been switched off since the last access to **SETUP/INSTAL**

Note: To access to the installation menus you can select the ”PASSWD” key and compose the password (given at the training course). And press the ”SETUP” key.

3. Starting from application mode, select **SETUP/INSTAL/AOP/COPY/SOURCE/SCREEN/NO** on the console.
4. Select **SETUP/FSC/FSC=*x***, where *x* is the screen pair indicator corresponding to an existing calibrated screen pair using the same cassette as the screen pair currently being calibrated.
5. Select **SETUP/SETUP/TARG/SCREEN/NO**.
6. Select **SETUP/FSC/FSC=*y*** , where *y* is the indicator of the screen pair being calibrated.

Note: To access to the installation menus you can select the ”PASSWD” key and compose the password (given at the training course). And press the ”SETUP” key.

7. Once you are SURE that the screen pair indicator *y* is correct, copy the ”without screen” parameters by selecting **SETUP/SETUP/COPY/VALID**. The message ”COPY EXECUTED” appears on the console display.
8. Select **SETUP/SOURCE/SCREEN/YES** on the console.
9. Select **SETUP/FSC/FSC=*x***, where *x* is the screen pair indicator corresponding to an existing calibrated screen pair using the same cassette as the screen pair currently being calibrated.
10. Select **SETUP/SETUP/TARG/SCREEN/YES**
11. Select **SETUP/FSC/FSC=*y***, where *y* is the indicator of the screen pair being calibrated.

CALIBRATION

CALIBRATION OF PHOTOMULTIPLIER CELL GAIN FOR A GIVEN SCREEN PAIR

12. Once you are SURE that the screen pair indicator *y* is correct, copy the ”with screen” parameters by selecting **SETUP/SETUP/COPY/VALID**. The message ”COPY EXECUTED” appears on the console display.

Senographe 800T (ONLY) Job Card CAL 008

Purpose: **CALIBRATION OF EXAMINATION ARM ANGLE MEASUREMENT**	Version No.: A Date: Dec. 18, 1995
Time: x h xx min	Personnel:

SECTION 1
SUPPLIES

None.

SECTION 2
TOOLS

None.

SECTION 3
SAFETY PRECAUTIONS

None.

SECTION 4
PREREQUISITES

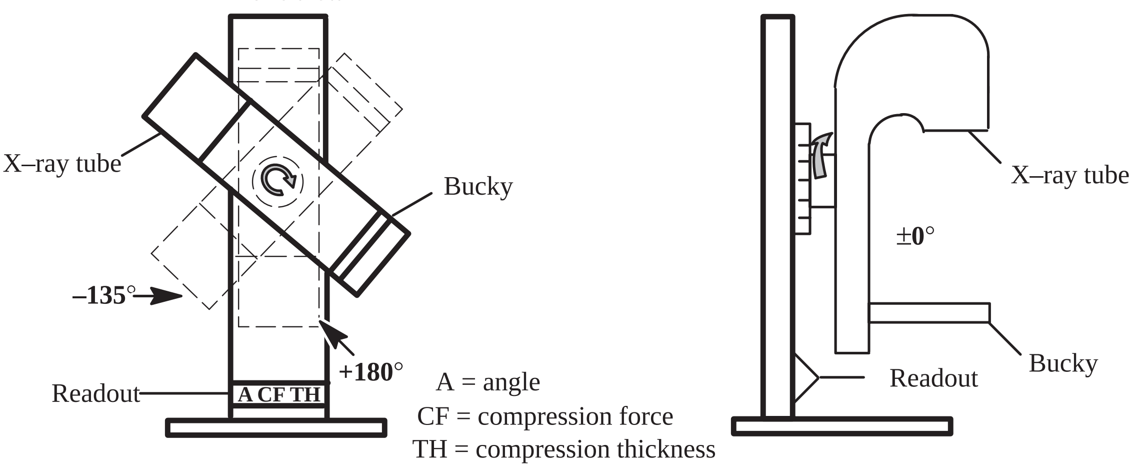
Note: In case of error messages during this calibration, see CAL 023 ”GENERAL ERRORS DURING THE CALIBRATION” for explanations.

SECTION 5
ADVANCE PREPARATION AND INFORMATION

Note: Refer to Job Card DR 008 for angular potentiometer installation.

Do not go up in the menu structure higher than indicated in the procedure being performed. Doing so will reset stored intermediate values and ruin the calibration.

ILLUSTRATION 1
HOW TO MOVE THE ARM DURING THE CALLIBRATION



SECTION 6
CALIBRATION OF EXAMINATION ARM ANGLE MEASUREMENT

The objective is to calibrate the angulation detector, by measuring and entering 3 different angles.

6.1 Prepare the Senographe for the tests

Starting from application mode, change the position of the installation menu enable switch (switch 8 of B1 on 300PL4 CPU board, see ”Accessing the Different Installation Menus in the Tree Structure” in Chapter 1).

Note: To access to the installation menus you can select the ”PASSWD” key and compose the password (given at the training course). And press the ”SETUP” key.

Note: This must only be done if the Senographe has been switched off since the last access to **SETUP/INSTAL**

6.2 Perform the calibration

Note: If the arm will not rotate, because of brake heating, wait 30 mn.

1. Move the compression paddle to a distance more than 10 cm above the bucky to allow rotation movement.
2. Starting from application mode, select **SETUP/INSTAL/ARM/ANGLE/CALIB/MEASURE** on the console. The message ”ANGLE DETECTOR MEASUREMENTS 1” appears on the display.
3. Turn the arm 90° to the right (as indicated in Illustration 1).
4. Press the ”**90**°” key on the console. The message ”90” appears on the display.

Note: If the message ”Err” appears on the display the value is out of range. Check the potentiometer installation and repeat Sections 6.2.1 to 6.2.3.

5. Turn the arm back 90° to the left till the next detent, i.e. 0°.
6. Press the ”**0**°” key on the console. The message ”0” appears on the display.
7. Turn the arm back 90° again to the left till the next detent, i.e. –90°, and press the corresponding key on the console.
8. Select **SETUP/CALCUL** on the console. This procedure checks the coherency within the values. The message ”END of calcul” appears on the console.

Note: If the message ”Calib. error” appears on the display, one of the measures was probably not done correctly. Press **SETUP/MEASURE** and check if the message ”Err” is written. If so repeat the measurement corresponding to the ”Err” and select **SETUP/CALCUL.**

9. Perform a ”CKSUM” and return to application mode.

6.3 Check the results

1. Turn the arm 180° to the right and check that the value, displayed on the gantry panel, is exact.
2. Turn the arm to –135° and check that the value, displayed on the gantry panel, is exact.
3. Turn the arm to the right and check, every 30°, that the value, displayed on the gantry panel is exact.

6.4 Return the Senographe to its normal state

1. If you’re turning the Senographe back over to the user at this point, turn the Senographe off, then on again.

CALIBRATION OF EXAMINATION ARM ANGLE MEASUREMENT	Job Card CAL 008	4 of 4

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Senographe 800T (ONLY) Job Card CAL 009

Purpose: **CALIBRATION OF BREAST THICKNESS MEASUREMENT**	Version No.: A Date: Dec. 18, 1995
Time: x h xx min	Personnel: 1

SECTION 1
SUPPLIES

None.

SECTION 2
TOOLS

Plexiglass in thickness increments of 0.5 cm (minimum plexiglass dimensions 15 x 15 cm).

SECTION 3
SAFETY PRECAUTIONS

None.

SECTION 4
PREREQUISITES

- Job Card CAL 019 ”CALIBRATION OF COMPRESSION FORCE DETECTOR”.

Note: In case of error messages during this calibration, see CAL 023 ”GENERAL ERRORS DURING THE CALIBRATION” for explanations.

SECTION 5
ADVANCE PREPARATION AND INFORMATION

Note: Refer to Job Card DR 020 for Thickness potentiometer installation.

NEVER go up in the menu structure higher than indicated in the procedure being performed. Doing so will reset stored intermediate values and ruin the calibration.

SECTION 6
CALIBRATION OF BREAST THICKNESS MEASUREMENT

The objective is to calibrate the thickness detector and the breast thickness measurement. Since the compression paddle and its drive train, as well as the cassette holder or the magnification device undergo deflection when under compression, a compensation factor must be calculated to correct this thickness in function of compression force.

Three calibrations must be done, two for contact mode and one for magnification mode.

6.1 Prepare the Senographe for the calibrations

Starting from application mode, change the position of the installation menu enable switch (switch 8 of B1 on 300PL4 CPU board, see ”Accessing the Different Installation Menus in the Tree Structure” in Chapter 1).

Note: This must only be done if the Senographe has been switched off since the last access to **SETUP/INSTAL**

Note: To access to the installation menus you can select the ”PASSWD” key and compose the password (given at the training course). And press the ”SETUP” key.

6.2 Perform automatic potentiometer calibration

1. Make sure that the calibration of the compression force has been done (see Job Card CAL 019 ”CALIBRATION OF COMPRESSION FORCE DETECTOR”).
2. Starting from application mode, select **SETUP/MEDICAL/FORCE.**
   Set up medical Force to 20 daN and enter this value with the **VALID** key.
3. Set up the Senographe in contact mode with the 18 x 24 compression paddle installed.
4. Starting from application mode, select **SETUP/INSTAL/ARM/THICK** on the console.
5. Lower the compression paddle until the compression force is greater than 3 daN (read it on the display panel).
6. Select **POTENT.** on the console. Wait until the paddle has reached its top position and the message ”End of calcul” appears on the console display.

- If the message ”1 measure less” appears on the console display, check that there is nothing between the paddle and the bucky and that the force has been calibrated (the force should be zero when the paddle is not under compression). Repeat steps 2. to 5. in Sections 6.2.
- If the message ”Calib. error” appears on the console display, check the potentiometer installation and repeat steps 2. to 5. in Sections 6.2.

6.3 Perform the contact mode calibration

1. Set up the Senographe in contact mode with the 18 x 24 compression paddle installed.
2. Select **CONTACT/CALIB** on the console.
3. Lower the compression paddle into contact with the cassette holder. Using the compression fine–adjustment knob, adjust the compression to between 3 and 5 daN as read on the gantry display panel. Press the ”<5daN” key on the console.

   The message ”5 daN” appears on the display.

4. Increase the compression to between 15 and 20 daN as read on the gantry display panel. Press the ”>15daN” key on the console. The ”Calcul” key appears on the console display.

   The message ”15 daN” appears on the display.

Note: It is normal for the paddle to move slightly when <5 daN is pressed.

5. Press the ”Calcul” key on the console. This executes the calibration calculation for contact mode. The message ”END of CALCUL” appears on the console display.

6.4 Check the contact mode calibration results

1. Request a total decompression of the compression paddle.
2. Keeping the Senographe in contact mode, place 4 cm of plexiglass on the cassette holder.
3. Lower the compression paddle into contact with the plexiglass.
4. Verify, for any compression force between 0 and 20 daN of compression (as displayed on the gantry display panel), that the breast thickness displayed on the gantry display panel does not vary outside the range of 35 to 45 mm (i.e. plexiglass thickness of 40 mm, ± 5 mm).

6.5 Perform the magnification mode calibration

1. Install the 1,5 magnification device and the 18 x 24 compression paddle.
2. Select **SETUP/SETUP/MAGNIF/CALIB** on the console.

Note: If the message ”1 measure less” appears on the console display the automatic potentiometer calibration has not been done properly. Repeat steps 2. to 5. in Sections 6.2.

3. Lower the compression paddle into contact with the magnification device. Using the compression fine–adjustment knob, adjust the compression to between 3 and 5 daN as read on the gantry display panel. Press the ”<5daN” key on the console.

   The message ”5 daN” appears on the display, if not verify the magnification.

4. Increase the compression to between 15 and 20 daN as read on the gantry display panel. Press the ”>15daN” key on the console. The ”Calcul” key appears on the console display.
   The message ”15 daN” appears on the display.

Note: It is normal for the paddle to move slightly when <5 daN is pressed.

5. Press the ”Calcul” key on the console. This executes the calibration calculation for magnification mode.

   The message ”END of CALCUL” appears on the console display.

CALIBRATION

6.6 Check the magnification mode calibration results

1. Request a total decompression of the compression paddle.
2. Place 4 cm of plexiglass on the magnification device.
3. Lower the compression paddle into contact with the plexiglass.
4. Verify that for any compression force between zero and 20 daN (displayed on the gantry display panel), the breast thickness displayed on the gantry display panel does not vary outside the range of 35 to 45 mm (i.e. plexiglass thickness of 40 mm, ± 5 mm).

6.7 Return the Senographe to its normal state

1. Perform a ”CKSUM” and return to application mode.
2. If you’re turning the Senographe back over to the user at this point, turn the Senographe off, then back on again.

Senographe 700T and 800T Job Card CAL 010

Purpose: **AUTOMATIC X–RAY TUBE WARM–UP**	Version No.: 0 Date: Dec. 18, 1995
Time: x h xx min	Personnel: 1

SECTION 1
SUPPLIES

None.

SECTION 2
TOOLS

None.

SECTION 3
SAFETY PRECAUTIONS

CAUTION

These procedures produce x–rays. Be sure to take appropriate precautions.

SECTION 4
PREREQUISITES

This Job Card should only be used when the performance of Job Card CAL 003 ”CALIBRATION OF X–RAY TUBE HEATER CURRENT” has been impossible due to excessive arcing.

Note: In case of error messages during this calibration, see CAL 023 ”GENERAL ERRORS DURING THE CALIBRATION” for explanations.

SECTION 5
AUTOMATIC X–RAY TUBE WARM–UP

This Job Card provides the procedure for re–starting an X–ray tube that was known to be good upon leaving the factory, but which now exhibits arcing after a long period of inactivity.

The principle is to take a series of 4 pre–determined exposures, starting at low kV values and progressively increasing towards high kV values. If arcing occurs during an exposure, some or all exposures are automatically repeated. If persistent arcing occurs, the software automatically terminates the warm–up procedure.

CALIBRATION

AUTOMATIC X–RAY TUBE WARM–UP

Job Card CAL 010

5.1 Prepare the Senographe

Starting from application mode, change the position of the installation menu enable switch (switch 8 of B1 on 300PL4 CPU board, see ”Accessing the Different Installation Menus in the Tree Structure” in Chapter 1).

Note: To access to the installation menus you can select the ”PASSWD” key and compose the password (given at the training course). And press the ”SETUP” key.

Note: This must only be done if the Senographe has been switched off since the last access to **SETUP/INSTAL**

1. Select **SETUP/INSTAL/GENE/TUBE/WarmUp** on the console. The track/kV combination for the first exposure should appear on the console display.

5.2 Perform X–ray tube warm–up

2. Press the 2nd trigger button and HOLD IT DOWN while the exposures are taken.

Note: There is a time delay of 10 seconds between exposures. You can release the 2nd trigger button during this 10 second period, then press it again to continue, but the minimum time between exposures will still be 10 seconds. If the tube overheats at some point, exposures will be inhibited until it cools down again. During the cooling period, the 2nd trigger button can be released; as soon as the display shows that the x–ray tube has sufficiently cooled, press the 2nd trigger button to continue.

3. When the warm–up procedure is finished, the message ”Tube OK” normally appears on the console display. If persistent arcing occurred during the procedures, the message ”Too many spits” appears on the console display.

Senographe 700T and 800T Job Card CAL 011

Purpose: **SETTING OF ELEVATOR UPPER TRAVEL LIMIT**	Version No.: 1 Date: Dec. 18, 1995
Time: 30 min	Personnel: 1

SECTION 1
SUPPLIES

None.

SECTION 2
TOOLS

Allen wrench 3 mm.

SECTION 3
SAFETY PRECAUTIONS

No specific safety precautions are applicable.

SECTION 4
PREREQUISITES

Note: In case of error messages during this calibration, see CAL 023 ”GENERAL ERRORS DURING THE CALIBRATION” for explanations.

SETTING OF ELEVATOR UPPER TRAVEL LIMIT

Job Card CAL 011

SECTION 5
PROCEDURE

- Measure room overall height, floor to ceiling.
- Remove left cover from column housing (as viewed from the patients point of view).

  See Job Card DR 005 ”REMOVING AND RE–INSTALLING THE FRONT COVER OF THE COLUMN”.

5.1 Determine limit switch position (see Illustration 1)

The position of the limit switch is determined as follows :

1. Ceiling height 2.33 m or greater :
   – Install the limit switch in the upper mounting hole (item 1, Illustration 1).

Note: The Senographe is delivered with the limit switch is installed in this position.

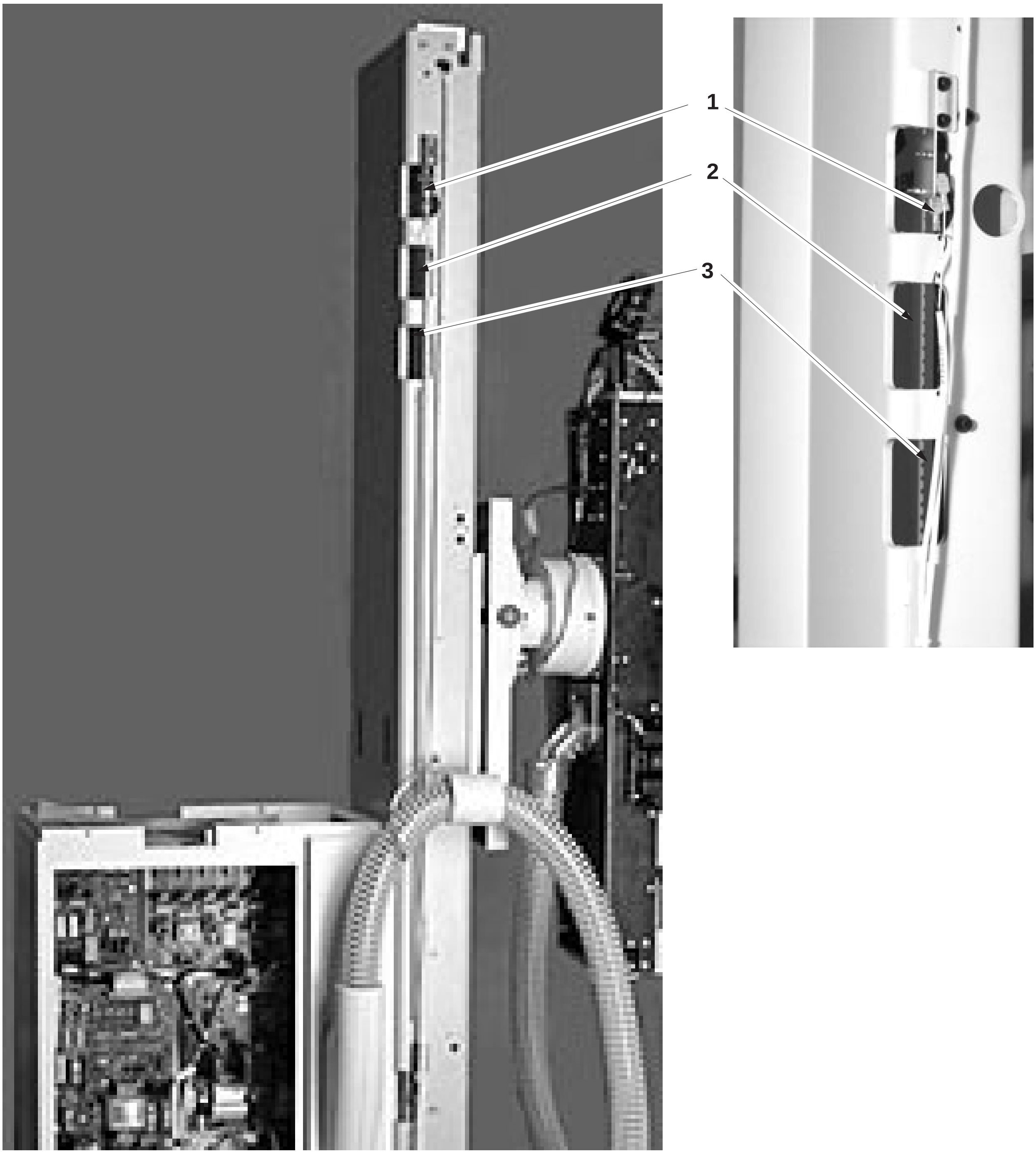
2. Ceiling height 2.23 m or greater, but less than 2.33 m:
   – Install the limit switch in the middle mounting hole (item 2, Illustration 1).
3. Ceiling height 2.13 m or greater, but less than 2.23 m:
   – Install the limit switch in the lower mounting hole (item 3, Illustration 1).
4. Ceiling height less than 2.03 m:
   – **The Senographe cannot be installed without special modification**.

5.2 Repositioning of the limit switch

1. Remove the tyraps on the cable connected to the limit switch.
2. Remove the two 3 mm Allen screws securing the sensor.
3. Remove the limit switch and reinstall it in its new position, as determined in 5.1, above.
4. Reinstall and tighten the two 3 mm Allen screws, in the new position.
5. Reinstall tyraps on the sensor cable, as required.
6. Switch on the Senographe, carry out a column raising and lowering test and check that the tube housing cover does not collide with the ceiling (check minimum clearance of at least 8 cm to 9 cm, for safety).

SETTING OF ELEVATOR UPPER TRAVEL LIMIT	Job Card CAL 011	3 of 4

ILLUSTRATION 1
SENOGRAPHE, SHOWING LIMIT SWITCH POSITIONS



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Senographe 700T and 800T Job Card CAL 012

Purpose: **CHECKING SAFE–LIGHTING AND FILM PROCESSING**	Version No.: 1 Date: Dec. 18, 1995
Time: 15 min	Personnel: 1

SECTION 1
SUPPLIES

Supply of undeveloped film of type used by the customer.

SECTION 2
TOOLS

- Plexiglass, 4 cm.
- Sensitometer.
- Densitometer.
- 2 Opaque sheets.

SECTION 3
SAFETY PRECAUTIONS

None.

SECTION 4
PREREQUISITES

Note: In case of error messages during this calibration, see CAL 023 ”GENERAL ERRORS DURING THE CALIBRATION” for explanations.

SECTION 5
CHECKING FILM PROCESSING

The objective is to check the light–tightness of the darkroom, the influence of the safelighting and correct operation of the automatic film processor.

5.1 Check darkroom light–tightness and influence of safe–lighting.

1. Enter the darkroom and load a cassette with the film currently used for clinical purposes, taking care to protect it from possible fogging from the darkroom safe light or leakage.

Note 1 : The emulsion side of the film must be positioned facing the screen side of the cassette (away from the tube).

Note 2 : For Kodak Ortho–MA film, the emultion side is underneath when the notch is top left.

CHECKING SAFE–LIGHTING AND FILM PROCESSING | Job Card CAL 012

2. In 2–point mode, (HV: 28 kV, mAs=70, 4 cm of plexiglas) expose the cassette to the x–rays in such a way as to obtain a film with an optical density of between 0.8 and 1.4 (change mAs as necessary and repeat exposure with a fresh film).
3. Reload the cassette and make an exposure using the same factors; do not develop the film.
4. Unload the cassette in the darkroom and place the film on the work surface, emulsion side upwards and completely covered by an opaque sheet.
5. Move the second opaque sheet available for the next step.
6. Move the opaque sheet covering the film to the right, uncovering half the film (see illustration 1) and simultaneously activate the timer.
7. If this is the first maintenance inspection (reference test) proceed to the next step 8. in Section 5.1. If this is a periodic maintenance check, go to step 11. in Section 5.1.
8. After 15 seconds, cover about a quarter of the bottom lefthand part of the film with the second opaque sheet (see illustration 1, 1st area).
9. After 30 seconds, move the second opaque sheet upwards in such a way as to cover about half of the lefthand part of the film (2nd area).
10. After one minute, move the second opaque sheet upwards to cover about three quarters of the lefthand part of the film (3rd area).
11. After 2 minutes, cover the film completely with the first opaque sheet.

Note 1 : If the film is to be handled in the darkroom for long periods (more than one minute), it should be tested in 5 positions and left for 2 extra minutes in the last position.

Note 2 : If this is a periodic maintenance check, one exposure of the film (of 2 to 4 minutes according to requirements) will be sufficient.

12. Develop the film, protecting it with the opaque sheet until it is inserted in the automatic processor.
13. Write the following data on the developed film :
    - Date and time.
    - Site & System ID’s.
14. Look for the first area on the film in which the frame line is visible (see Illustration 1) and note down the time corresponding to the area concerned on the film.
15. Interpreting the results

    The time obtained, corresponding to the first visible area, should not be less than 2 minutes.

Note: The ”laboratory safety time”, defined as half the period of time corresponding to the first visible area, should also be at least one minute.

CALIBRATION

16. Decisions

    a. If the time corresponding to the first visible area is greater than 2 minutes, go on to step 7. in Section 5.1.

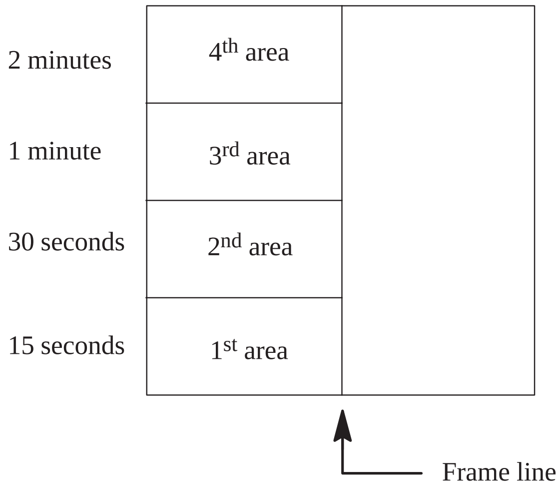
    b. If the time is less than 2 minutes, check that:

    – The safelighting complies with requirements.

    – There is no visible light leak (door, ceiling, floor, pipe ducts, etc.)
    Inform the user of these problems and take the necessary steps to obtain correct results in subsequent tests.

    c. If the time is less than 1 minute, priority must be given to solving the problem to enable the tests to continue.

ILLUSTRATION 1



17. Use the densitometer to measure the relative optical density on both parts of the film.

    CRITERION 1: Any difference between the relative optical densities measured must be less than 0.1.

    CRITERION 2: Neither optical density measured must exceed 0.2 (except for certain fast films).

18. If either or both of the above two criteria are not met:

    a. Check the light–tightness of the darkroom by repeating steps 1. to 17. in Section 5.1. with the safelight turned OFF.

    b. Check the safelight itself.

5.2 Check automatic film processor.

1. Perform a sensitometry test on the type of film being used by the customer.

Note: Be sure that the sensitometer is in the green position.

2. Develop the film.
3. Calibrate the densitometer to zero on step 1 on the sensitometric strip.
4. Use the densitometer to find the first step whose relative optical density is greater than or equal to 1. Let N be the step found and D(N) its relative optical density.
5. Measure the relative optical density for step (N+2). Let this measured value be D(N+2).
6. Calculate the film gamma:

$$\text{Gamma} = \frac{D(N+2) - D(N)}{0.3}$$

CRITERION: Check that the gamma calculated corresponds to that given by the film manufacturer within a tolerance of ± 0.35 (e.g. gamma ≈ 3.2 for Kodak Ortho–Ma film).

7. If the above criterion is not met, automatic film processor must be checked (temperature, cleanliness, change in chemicals, etc.).

Senographe 700T and 800T Job Card CAL 013A

Purpose: **CALIBRATION OF FILM RECIPROCITY LAW FAILURE COMPENSATION FOR A GIVEN SCREEN PAIR**	Version No.: A Date: April 4, 2001
Time: 45 min to 1 h 20 min	Personnel: 1

Note: **This procedure applies to the Senographes equiped with the “CAL007 6–parameter software”, i.e., a software version lower or equal to V2.21.**

SECTION 1
SUPPLIES

- Normal cassette and a supply of unexposed films of type used in the screen pair being calibrated.
- Bucky 18 x 24.

SECTION 2
TOOLS

- Densitometer.
- Sensitometer.
- Plexiglass in thickness increments of 0.5 cm (minimum plexiglass dimensions 20 x 20 cm to insure complete covering of the photo cell).

SECTION 3
SAFETY PRECAUTIONS

CAUTION

NEVER leave the Senographe unattended during calibration of a screen pair unless the screen pair is disabled.

CAUTION

These procedures produce X–rays. Be sure to take appropriate precautions.

SECTION 4
PREREQUISITES

The chronological order of AEC calibration given in Installation Steering in Chapter 1 must be strictly followed for each screen pair. In particular, the three film reciprocity law failure compensation parameters A0, A1 and A2 for the screen pair being calibrated must be UNKNOWN. If they are known, it is useless to follow the procedures in this Job Card. See AEC calibration sequence given in Installation Steering in Chapter 1.

Note: In case of error messages during this calibration, see CAL 023 ”GENERAL ERRORS DURING THE CALIBRATION” for explanations.

SECTION 5
PREPARE THE SENOGRAPHE FOR THESE PROCEDURES.

Starting from application mode, change the position of the installation menu enable switch (switch 8 of B1 on 300PL4 CPU board, see ”Accessing the Different Installation Menus in the Tree Structure” in Chapter 1).

Note: This must only be done if the Senographe has been switched off since the last access to **SETUP/INSTAL**

Note: To access to the installation menus you can select the ”PASSWD” key and compose the password (given at the training course). And press the ”SETUP” key.

SECTION 6
PERFORM FILM RECIPROCITY LAW FAILURE COMPENSATION CALIBRATION.

There are two objectives:

- Calibrate the Senographe for correct film blackening when in AEC (1–point) or AOP (0–point) mode. This is done in Section 6.4.
- Determine the film reciprocity law failure compensation parameters A0, A1 and A2 for the screen pair being calibrated. These parameters are determined jointly by the screen pair and the characteristics of the Senographe product. This determination is done in section 6.5.

GENERAL INSTRUCTIONS TO BE OBSERVED DURING ALL PROCEDURES GIVEN BELOW IN THIS SECTION:

- The photo cell must be in its most forward position (towards the patient) throughout the procedures in this Job Card.
- When placing plexiglass on the cassette holder, the plexiglass must always overlap the front edge (towards the patient) by about 1 cm to insure that the photo cell is fully covered.
- Whenever optical density of a film is measured, the measurement is always relative to the film base fog level. Thus, you must null out the densitometer on the film base fog, **then** measure the **relative** density in the middle of the film, ALWAYS IN THE SAME PLACE.
- To avoid confusing results (for you and the software), take care to avoid patting the single–sided film upside–down in the cassette.
- The minimum number of films to expose during this procedure is 9 films.

6.1 Calibrate X–ray tube heater current

8. If you have performed the calibration JobCard CAL007 or JobCard CAL003 just before, then go directly to section 6.2.
9. Perform the calibration JobCard CAL003 for the large focus only.

6.2 Calibrate X–ray tube heater current at 30 mA

CAUTION **Protect the photocell with 4 cm of plexiglass.**

Starting from application mode, select **SETUP/INSTAL/AOP/ALGO/FSC=x/CALIB/LNRT/HEATER/ CALIB** on the console, where *x* is the screen pair indicator (A,B,C,D,E) corresponding to the screen pair being calibrated. See Job Card CAL 006 ”SCREEN PAIR SELECTION AND CONFIGURATION”. Press the 2nd trigger button and hold it down. A series of 3 X–ray exposures is taken. Release the 2nd trigger button.

Note: This calibration does not depend on any particular configuration of the Senographe, so it can be performed without any particular attention paid to presence or absence of accessories such as compression paddle, cassette, grid, etc. Never the less, it is better to protect photocell from direct X–ray by placing 3 plates of Plexi on Bucky.

Note: You might still do it to able the step 6.3.2

6.3 Calibrate the radiological thickness correction

1. Set up the Senographe in the following configuration.
   - Any compression paddle installed.
   - Contact (no magnification).
   - Grid installed.
2. Install the cassette loaded with fresh film corresponding to the screen pair being calibrated. Senographe
3. Select **SETUP/SETUP/THICK/1.5 cm**.
4. Place 1.5 cm of plexiglass on the bucky.
5. Press the 2nd trigger button and hold it down. When the message ”done” appears on the keyboard, release the 2nd trigger button.

Note: The film reciprocity law failure calibration uses different configuration and different plexiglass thickness configuration (1.5 cm ; 2 cm ; 4 cm ; 6 cm). In order to match correctly these different configuration, the software must know the exact correspondance between the differerent plexiglass thickness and the radiological thickness read by the software. (These two values must be quite the same...).

Note: The exposure performed in step 5 is used by the software to memorize the radiological thickness corresponding to 1.5 cm of plexiglass.

6. If you have performed the calibration JobCard CAL007 just before, then go directly to section 6.4. (In any doubt, perform the complete calibration)
7. Select SETUP/SETUP/THICK/2 cm
8. Place 2 cm of plexiglass on the bucky.
9. Press the 2nd trigger button and hold it down. When the message ”done” appears on the keyboard, release the 2nd trigger button.

Note: The exposure performed in step 9 is used by the software to memorize the radiological thickness corresponding to 2 cm of plexiglass.

10. Select SETUP/SETUP/THICK/6 cm
11. Place 6 cm of plexiglass on the bucky.
12. Press the 2nd trigger button and hold it down. When the message ”done” appears on the keyboard, release the 2nd trigger button.

Note: The exposure performed in step 12 is used by the software to memorize the radiological thickness corresponding to 6 cm of plexiglass. The corresondance for 4 cm of plexiglass will be automatically done during the calibration of the reference energy.

6.4 Calibrate reciprocity law failure reference energy

1. Select **SETUP/SETUP/PARAM** on the console. Verify the initial film reciprocity law failure compensation parameters A0, A1 and A2 by rotating the kV dial through the three values. The initial parameter values are given below:
   - A0init = +1.890E–1 (0.189).
   - A1init = +5.968E–1 (0.5968).
   - A2init = +2.225E–2 (0.02225).

   If any of the parameter values are different from the initial values given above, correct them manually by pressing the **CHANGE** key, then enter the correct value using the **NEXT** and **VALID** keys and the kV dial. See ”Visual Display of Parameter Values” and ”Modification of a Parameter Value or Entry of a Measurement” in chapter 1. Once the value is entered and validated, press the **SETUP** key once to continue checking the remaining parameter values.

Note: With experience installing several Senographe’s, you may find sets of initial parameter values for certain screen pair types (i.e. high or low speed films, certain screen types) that result in fewer films being used to complete this calibration.

2. Ask the doctor for the desired reference optical density (generally between 1.0 and 1.5). Starting from application mode,
select **SETUP/INSTAL/AOP/ALGO/FSC=x/CALIB/LNRT/REFEN/ OD_ref/CHANGE** on the console, where *x* is the screen pair indicator (A,B,C,D,E) corresponding to the screen pair being calibrated. See Job Card CAL 006 ”SCREEN PAIR SELECTION AND CONFIGURATION”. Enter the desired reference optical density by rotating the kV dial and using the **NEXT** and **VALID** keys. See ”Visual Display of Parameter Values” and ”Modification of a Parameter Value or Entry of a Measurement” in Chapter 1.
3. Perform a sensitometry test on the film being used with the screen pair being calibrated.
4. Select **SETUP/SETUP/SCALE** on the console. Rotate the kV dial until the value OD_3 is displayed on the console screen. Select **CHANGE** on the console. Enter the optical density from scale number 3 of the sensitometry test by using the **NEXT** and **VALID** keys and rotating the kV dial. See ”Visual Display of Parameter Values” and ”Modification of a Parameter Value or Entry of a Measurement” in Chapter 1.
5. Press the **SETUP** key on the console. Rotate the kV dial until the value OD_5 is displayed on the console screen. Select **CHANGE** on the console. Enter the optical density from scale number 5 of the sensitometry test by using the **NEXT** and **VALID** keys and rotating the kV dial.
6. Repeat step 5. in Section 6.4 for OD_7, OD_9, OD_11, OD_13 and OD_15 from the sensitometry test.
7. Set up the Senographe in the following configuration:
   - Any compression paddle installed.
   - Contact (no magnification).
   - Grid installed.
   - 4 cm plexiglass on the bucky.
8. Install the cassette loaded with fresh film corresponding to the screen pair being calibrated.
9. IF this is the **FIRST** exposure, select **SETUP/SETUP/CALIB/CALIB** on the console. For **SUBSEQUENT** exposures (if any) select only **SETUP/CALIB** on the console. Press the 2nd trigger button and hold it down. A single x–ray exposure is taken. Release the 2nd trigger button.

Note: By default, the first exposure is taken at +7.000E+1 (70) mAs. As you acquire experience installing the Senographe, you will find that for certain slower speed films, this calibration can be done using fewer films if the initial mAs value is increased. To do this, prior to pressing the 2nd trigger button, select **SETUP/SETUP/MAS/CHANGE** on the console and enter the desired initial mAs value using the NEXT and VALID keys and rotating the kV dial. See ”Visual Display of Parameter Values” and ”Modification of a Parameter Value or Entry of a Measurement” in Chapter 1. Then select **SETUP/SETUP/CALIB/CALIB** on the console and proceed with the exposure.

10. Develop the film and measure its optical density.

Note: The grid is not activated during this calibration mode exposure, so it is normal to see grid lines on the developed film.

11. Select **SETUP/OD_mea** on the console. Use the **NEXT** and **VALID** keys and the kV dial to enter the measured optical density value. See ”Visual Display of Parameter Values” and ”Modification of a Parameter Value or Entry of a Measurement” in Chapter 1.
12. Select **SETUP/CALC/VALID** on the console to execute the calculation. At this point, either the result is satisfactory, and the software displays ”calib end ” on the console display, or, if another exposure and re–calculation are necessary, the software displays ”another film”.
    - In the latter case, re–load the cassette with fresh film and repeat steps 8. to 12. in Section 6.4 WITHOUT CHANGING MANUALLY THE MAS VALUE. The software will have calculated a new mAs value for this exposure. Normally, no more than 2 or 3 films need to be used before ”CALIB END” appears on the console display following the calculation, indicating a satisfactory result.

Note: It is useful to note the updated mAs value determined by the software before taking the second and any subsequent exposures. This can give you an idea of the initial mAs values needed for certain film types to reduce the number of films needed during future Senographe installations. See Note in step 9. in Section 6.4

6.5 Calibrate film reciprocity law failure compensation parameters

1. Set up the Senographe in the following configuration:
    - Any compression paddle installed.
    - Contact (no magnification).
    - Grid installed.

Note: To determine the parameters A0,A1, A2 of the non reciprocity law failure, it is necessary to perform a certain amount of exposures at different exposure time. The exposure that will be used to determine the parameters A0,A1 and A2 are those which have an optical density close to the target optical density (OD_target +/– 0.1). The exposure time that we need to reach during the entire calibration follow this sequence : 0.1 sec ; 2 sec ; 8 sec ; 0,1 sec ; 1 sec or 0,5 sec ; 4 sec.

2. Select **SETUP/SETUP/SETUP/LNRT** on the console.

Note: There is a delay of about 2 seconds between the moment when the LNRT key is pressed and the appearance of the succeeding sub–menu titles. This is due to a calculation that the software performs to determine, among other things, the plexiglass thickness necessary for the calibration.

3. Place the amount of plexiglass indicated on the console display on the bucky and install the cassette loaded with fresh film corresponding to the screen pair being calibrated.
4. Press the **CALIB** button,

Note: The keyboard displays the exposure time which has to be reached. This data is useful to track the advancing of the calibration. Depending on the reference energy, the two possible sequences are (0,1 sec ; 2 sec ; 8 sec ; 0,1 sec ; 1 sec ; 4 sec) or (0,1 sec ; 2 sec ; 8 sec ; 0,1 sec ; 0,5 sec ; 4 sec).

5. Press the 2nd trigger button and hold it down. A single x–ray exposure is taken. Release the 2nd trigger button.

Note: The exposure time can be very short (100 ms) or very long (9 s), so be sure to hold the 2nd trigger button down constantly until the exposure is complete.

6. Develop the film and measure its optical density.

Note: The grid is not activated during this calibration mode exposure, so it is normal to see grid lines on the developed film.

7. Select **SETUP/OD_mea** on the console. Use the **NEXT** and **VALID** keys and the kV dial to enter the measured optical density value. See ”Visual Display of Parameter Values” and ”Modification of a Parameter Value or Entry of a Measurement” in Chapter 1.
8. Select **SETUP/CALC/VALID** on the console to execute the calculation. At this point, either the result is satisfactory, and the software displays ”calib end” or ”calib end (A2m)” on the console display, or, if another exposure and re–calculation are necessary, the software displays ”another film”.
   - In the latter case, press the **SETUP** key once and repeat sections 3. to 8. As many as 7 or 15 films may have to be used before ”calib end” or ”calib end (A2m)” appears on the console display following the calculation, indicating a satisfactory result.

Note: Be sure to update the amount of plexiglass on the bucky (if necessary) according to the indication on the console display.

Note: To determine the value of the parameter A2, the software may use two different algorithm depending on the value of the A0 and A1. When the message ”calib end” appears on the console display, this means that the first algorithm has been used. When the message ”calib end (A2m)” appears, this means that the second algorithm has been used.

9. Select **SETUP/SETUP/PARAM** on the console and note down the three film reciprocity law failure compensation parameters A0, A1 and A2 by rotating the kV dial.

Note: Keep these three parameter values with the table in Installation Steering in chapter 1, once you have verified them in Section 6.7 below. They can be used in the future to avoid repeating this Job Card during installation of other Senographe’s with the same screen pair. The ”Installation Steering” Section explains how to perform the calibration when these parameters are known.

6.6 Set manual density correction step size

1. Ask the doctor the desired manual density correction step size.

   For example, if the step size is chosen to be +1.000E–1 (0.1), then, assuming that the reference optical density is 1.0, the available range of corrected optical density goes from 0.5 to 1.5 in steps of 0.1 in AEC and AOP application modes.
2. Select **SETUP/SETUP/Energ/PARAM/D_STEP/CHANGE** on the console. Use the NEXT and VALID keys and the kV dial to enter the desired manual density correction step size value. See ”Visual Display of Parameter Values” and ”Modification of a Parameter Value or Entry of a Measurement” in Chapter 1.

6.7 Check results.

1. If necessary, enable use of the screen pair being calibrated by selecting **SETUP/SETUP/SETUP/SETUP/SETUP/VALID/YES** on the console.
2. Perform a ”CKSUM” and go to application mode.
3. Set up the following exposure configuration:
   - Mode: AEC (1–point)
   - Screen pair: Select the name of the screen pair being calibrated
   - Focal spot: **LARGE**
   - Track: **MO**
   - Filter: **MO**
   - Manual density correction: **+0**
4. Keep the Senographe in the same configuration as given in step 1. in Section 6.5.
5. Take three exposures, using the screen pair being calibrated, with the following kV and plexiglass thicknesses, measuring and noting down the optical density of the film and the mAs obtained for each one:
   - 28 kV with 4 cm of plexiglass.
   - 32 kV with 1.5 cm of plexiglass.
   - 28 kV with 5.5 cm of plexiglass.

Note: Since these exposures are taken in application mode, the grid is activated during the exposures and thus no grid lines should be visible on the developed films.

The optical density must not vary by more than 0.2 between any two of the three films. If it does, the entire calibration must be repeated.

CAUTION

Do not, under ANY CIRCUMSTANCES, attempt to ”tweak” manually any of the parameters determined by the calibration procedures in this Job Card. If the optical density is outside the above–defined tolerance, there is a reason which must be corrected; correct the problem and repeat the entire calibration. A satisfactory result MUST be obtained for this criterion before proceeding to the next criterion below.

Once the variation in optical density between the three films is satisfactory, check that the optical density of the 28kV/4 cm film is inside the tolerance of the reference optical density ±0.1 (the reference optical density was chosen step 2. in Section 6.4).

If the optical density is outside this tolerance, the reference energy must be calibrated as indicated in Job Card CAL 014 ”CALIBRATION OF REFERENCE ENERGY FOR A GIVEN SCREEN PAIR”.

To do this, perform the following sequence:

a. Perform the section entitled ”Perform calibration of reference energy.” in Job Card CAL 014 ”CALIBRATION OF REFERENCE ENERGY FOR A GIVEN SCREEN PAIR”.

Note: The reference optical density MUST be re–entered following the menu sequence given in Job Card CAL 014.

Note: For the initial calibration attempt, DO NOT use the default mAs value of +7.000E+1 (70). Instead, use the mAs value obtained above from the 28 kV/4 cm check exposure.

b. Perform the section entitled ”Check results.” in Job Card CAL 014.

6. If necessary, disable use of the screen pair being calibrated. (From application mode, select **SETUP/INSTAL/AOP/ALGO/FSC=x/VALID/NO** on the console.) (See CAUTION in Section 3.)

7. Perform a **”CKSUM”** and go to application mode.

Note: The strategy of AOP is automatically calculed at the end of this Job Card.

Note: To check this AOP strategy see Job Card CAL 022 ”MANUAL DETERMINATION OF AOP STRATEGY FOR A GIVEN SCREEN PAIR” step 3. in function of the mAs value obtained from the 28 kV/4 cm check exposure.

CALIBRATION

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Senographe 700T and 800T — Job Card CAL 013B

Purpose: **CALIBRATION OF FILM RECIPROCITY LAW FAILURE COMPENSATION FOR A GIVEN SCREEN PAIR**	Version No.: A Date: March 13, 2001
Time: 45 min to 1 h 20 min	Personnel: 1

Note: **This procedure applies to the Senographes equiped with the "CAL007 9–parameter software", i.e., a software version higher or equal to V2.31.**

SECTION 1
SUPPLIES

- Normal cassette (keep the same cassette for all the procedure) and a supply of unexposed films of type used in the screen pair being calibrated.
- Bucky 18 x 24.

SECTION 2
TOOLS

- Densitometer.
- Sensitometer.
- Plexiglass in thickness increments of 0.5 cm (minimum plexiglass dimensions 20 x 20 cm to insure complete covering of the photo cell).

SECTION 3
SAFETY PRECAUTIONS

CAUTION

NEVER leave the Senographe unattended during calibration of a screen pair unless the screen pair is disabled.

CAUTION

These procedures produce X–rays. Be sure to take appropriate precautions.

SECTION 4
PREREQUISITES

The chronological order of AEC calibration given in Installation Steering in Chapter 1 must be strictly followed for each screen pair. In particular, the three film reciprocity law failure compensation parameters A0, A1 and A2 for the screen pair being calibrated must be UNKNOWN. If they are known, it is useless to follow the procedures in this Job Card. See AEC calibration sequence given in Installation Steering in Chapter 1.

Note: In case of error messages during this calibration, see CAL 023 "GENERAL ERRORS DURING THE CALIBRATION" for explanations.

SECTION 5
PREPARE THE SENOGRAPHE FOR THESE PROCEDURES.

Starting from application mode, change the position of the installation menu enable switch (switch 8 of B1 on 300PL4 CPU board, see ”Accessing the Different Installation Menus in the Tree Structure” in Chapter 1).

Note: This must only be done if the Senographe has been switched off since the last access to **SETUP/INSTAL**

Note: To access to the installation menus you can select the ”PASSWD” key and compose the password (given at the training course). And press the ”SETUP” key.

SECTION 6
PERFORM FILM RECIPROCITY LAW FAILURE COMPENSATION CALIBRATION.

There are two objectives:

- Calibrate the Senographe for correct film blackening when in AEC (1–point) or AOP (0–point) mode. This is done in Section 6.4.
- Determine the film reciprocity law failure compensation parameters A0, A1 and A2 for the screen pair being calibrated. These parameters are determined jointly by the screen pair and the characteristics of the Senographe product. This determination is done in section 6.5.

GENERAL INSTRUCTIONS TO BE OBSERVED DURING ALL PROCEDURES GIVEN BELOW IN THIS SECTION:

- The photo cell must be in **position 2** throughout the procedures in this Job Card.
- When placing plexiglass on the cassette holder, the plexiglass must always overlap the front edge (towards the patient) by about 1 cm to insure that the photo cell is fully covered.
- Whenever optical density of a film is measured, the measurement is always relative to the film base fog level (i.e., the **OD net value**). Thus, you must null out the densitometer on the film base fog, **then** measure the **relative** density in the middle of the film, ALWAYS IN THE SAME PLACE.
- To avoid confusing results (for you and the software), take care to avoid patting the single–sided film upside–down in the cassette.
- The minimum number of films to expose during this procedure is 9 films.

6.1 Calibrate X–ray tube heater current

8. If you have performed the calibration JobCard CAL007 or JobCard CAL003 just before, then go directly to section 6.2.
9. Perform the calibration Job Card CAL003 for the large focus only.

6.2 Calibrate X–ray tube heater current at 30 mA

CAUTION **Protect the photocell with 4 cm of plexiglass.**

Starting from application mode, select **SETUP/INSTAL/AOP/ALGO/FSC=x/CALIB/LNRT/HEATER/ CALIB** on the console, where *x* is the screen pair indicator (A,B,C,D,E) corresponding to the screen pair being calibrated. See Job Card CAL 006 ”SCREEN PAIR SELECTION AND CONFIGURATION”. Press the 2nd trigger button and hold it down. A series of 3 X–ray exposures is taken. Release the 2nd trigger button.

Note: This calibration does not depend on any particular configuration of the Senographe, so it can be performed without any particular attention paid to presence or absence of accessories such as compression paddle, cassette, grid, etc. Never the less, it is better to protect photocell from direct X–ray by placing 4 cm of Plexi on Bucky.

Note: You might still do it to able the step 6.3.2

6.3 Calibrate the radiological thickness correction

1. Set up the Senographe in the following configuration.
   - Any compression paddle installed.
   - Contact (no magnification).
   - Grid installed.
2. Install the cassette loaded with fresh film corresponding to the screen pair being calibrated. Senographe
3. Select **SETUP/SETUP/THICK/1.5 cm**.
4. Place 1.5 cm of plexiglass on the bucky.
5. Press the 2nd trigger button and hold it down. When the message ”done” appears on the keyboard, release the 2nd trigger button.

Note: The film reciprocity law failure calibration uses different configuration and different plexiglass thickness configuration (1.5 cm ; 2 cm ; 4 cm ; 6 cm). In order to match correctly these different configuration, the software must know the exact correspondance between the differerent plexiglass thickness and the radiological thickness read by the software. (These two values must be quite the same...).

Note: The exposure performed in step 5 is used by the software to memorize the radiological thickness corresponding to 1.5 cm of plexiglass.

6. Select SETUP/SETUP/THICK/2 cm
7. Place 2 cm of plexiglass on the bucky.
8. Press the 2nd trigger button and hold it down. When the message ”done” appears on the keyboard, release the 2nd trigger button.

Note: The exposure performed in step 8 is used by the software to memorize the radiological thickness corresponding to 2 cm of plexiglass.

9. Select SETUP/SETUP/THICK/6 cm
10. Place 6 cm of plexiglass on the bucky.
11. Press the 2nd trigger button and hold it down. When the message ”done” appears on the keyboard, release the 2nd trigger button.

Note: The exposure performed in step 12 is used by the software to memorize the radiological thickness corresponding to 6 cm of plexiglass. The corresondance for 4 cm of plexiglass will be automatically done during the calibration of the reference energy.

6.4 Calibrate reciprocity law failure reference energy

1. Select **SETUP/SETUP/PARAM** on the console. Verify the initial film reciprocity law failure compensation parameters A0, A1 and A2 by rotating the kV dial through the three values. The initial parameter values are given below:
   - A0init = +1.867E–1.
   - A1init = +4.628E–1.
   - A2init = +1.821E–1.

   If any of the parameter values are different from the initial values given above, correct them manually by pressing the **CHANGE** key, then enter the correct value using the **NEXT** and **VALID** keys and the kV dial. See ”Visual Display of Parameter Values” and ”Modification of a Parameter Value or Entry of a Measurement” in chapter 1. Once the value is entered and validated, press the **SETUP** key once to continue checking the remaining parameter values.

Note: With experience installing several Senographe’s, you may find sets of initial parameter values for certain screen pair types (i.e. high or low speed films, certain screen types) that result in fewer films being used to complete this calibration.

2. Ask the doctor for the desired reference net optical density (generally between 1.2 and 1.6). Starting from application mode,
select **SETUP/INSTAL/AOP/ALGO/FSC=x/CALIB/LNRT/REFEN/ OD_ref/CHANGE** on the console, where *x* is the screen pair indicator (A,B,C,D,E) corresponding to the screen pair being calibrated. See Job Card CAL 006 ”SCREEN PAIR SELECTION AND CONFIGURATION”. Enter the desired reference optical density by rotating the kV dial and using the **NEXT** and **VALID** keys. See ”Visual Display of Parameter Values” and ”Modification of a Parameter Value or Entry of a Measurement” in Chapter 1.
3. Perform a sensitometry test on the film being used with the screen pair being calibrated.
Note the measured values in IST011 Sensitometry test.
4. Select **SETUP/SETUP/SCALE** on the console. Rotate the kV dial until the value OD_1 is displayed on the console screen. Select **CHANGE** on the console. Enter the optical density from scale number 1 of the sensitometry test by using the **NEXT** and **VALID** keys and rotating the kV dial. See ”Visual Display of Parameter Values” and ”Modification of a Parameter Value or Entry of a Measurement” in Chapter 1.
Note: All sensitometric values are **OD net values**.
5. Press the **SETUP** key on the console. Rotate the kV dial until the value OD_2 is displayed on the console screen. Select **CHANGE** on the console. Enter the optical density from scale number 2 of the sensitometry test by using the **NEXT** and **VALID** keys and rotating the kV dial.
6. Repeat step 5. in Section 6.4 for OD_3, OD_4, OD_5, OD_6, etc..., until the step after the one higher than OD_max (2.8 per default). OD_MAX is the highest optical density which is taken into account for the model.
7. Set up the Senographe in the following configuration:
   - Any compression paddle installed.
   - Contact (no magnification).
   - Bucky with Grid installed.
   - 4 cm plexiglass on the bucky.
8. Install the cassette loaded with fresh film corresponding to the screen pair being calibrated.
9. IF this is the **FIRST** exposure, select **SETUP/SETUP/CALIB/CALIB** on the console. For **SUBSEQUENT** exposures (if any) select only **SETUP/CALIB** on the console. Press the 2nd trigger button and hold it down. A single x–ray exposure is taken. Release the 2nd trigger button.

Note: By default, the first exposure is taken at +7.000E+1 (70) mAs. As you acquire experience installing the Senographe, you will find that for certain slower speed films, this calibration can be done using fewer films if the initial mAs value is increased. To do this, prior to pressing the 2nd trigger button, select **SETUP/SETUP/MAS/CHANGE** on the console and enter the desired initial mAs value using the NEXT and VALID keys and rotating the kV dial. See ”Visual Display of Parameter Values” and ”Modification of a Parameter Value or Entry of a Measurement” in Chapter 1. Then select **SETUP/SETUP/CALIB/CALIB** on the console and proceed with the exposure.

10. Develop the film and measure its optical density.

11. Select **SETUP/OD_mea** on the console. Use the **NEXT** and **VALID** keys and the kV dial to enter the measured optical density value. See ”Visual Display of Parameter Values” and ”Modification of a Parameter Value or Entry of a Measurement” in Chapter 1.

12. Select **SETUP/CALC/VALID** on the console to execute the calculation. At this point, either the result is satisfactory, and the software displays ”calib end ” on the console display, or, if another exposure and re–calculation are necessary, the software displays ”another film”.

    - In the latter case, re–load the cassette with fresh film and repeat steps 8. to 12. in Section 6.4 WITHOUT CHANGING MANUALLY THE MAS VALUE. The software will have calculated a new mAs value for this exposure. Normally, no more than 2 or 3 films need to be used before ”CALIB END” appears on the console display following the calculation, indicating a satisfactory result.

Note: It is useful to note the updated mAs value determined by the software before taking the second and any subsequent exposures. This can give you an idea of the initial mAs values needed for certain film types to reduce the number of films needed during future Senographe installations. See Note in step 9. in Section 6.4

13. Note down the following information in the IST011B (CAL014 reference energy):

    - D_BF, D_MAX, A_SENS, B_SENS and SIGMA values:
      – select **SETUP/SETUP/PARAM/MODEL/RESULT/ ...** on the console.

Note: D_BF is the Base Fog Density. D_MAX is the saturation density for the model. This value is different from the actual saturation density, as the model is optimized to be accurate for the optical density lower than D_MAX. A_SENS and B_SENS are parameters used for modeling the sensitometric curve. SIGMA is the Optical Density standard deviation, between the model and the measured points.

Note: This model is not only used for this Job Card, but also for Manual Density Correction. The Model parameters are calculated from the optical density curve and must not be modified manually.

- The reference energy (select **SETUP/ENR_R** on the console).

6.5 Calibrate film reciprocity law failure compensation parameters

1. Set up the Senographe in the following configuration:

    - Any compression paddle installed.
    - Contact (no magnification).
    - Bucky with Grid installed.

Note: To determine the parameters A0,A1, A2 of the non reciprocity law failure, it is necessary to perform a certain amount of exposures at different exposure time. The exposure that will be used to determine the parameters A0,A1 and A2 are those which have an optical density close to the target optical density (OD_target +/– 0.1). The exposure time that we need to reach during the entire calibration follow this sequence : 0.1 sec ; 2 sec ; 8 sec ; 0,1 sec ; 1 sec or 0,5 sec ; 4 sec.

2. Select **SETUP/SETUP/SETUP/LNRT** on the console.

Note: There is a delay of about 2 seconds between the moment when the LNRT key is pressed and the appearance of the succeeding sub–menu titles. This is due to a calculation that the software performs to determine, among other things, the plexiglass thickness necessary for the calibration.

3. Place the amount of plexiglass indicated on the console display on the bucky and install the cassette loaded with fresh film corresponding to the screen pair being calibrated.
4. Press the **CALIB** button,

Note: The keyboard displays the exposure time which has to be reached. This data is useful to track the advancing of the calibration. Depending on the reference energy, the two possible sequences are (0,1 sec ; 2 sec ; 8 sec ; 0,1 sec ; 1 sec ; 4 sec) or (0,1 sec ; 2 sec ; 8 sec ; 0,1 sec ; 0,5 sec ; 4 sec).

5. Press the 2nd trigger button and hold it down. A single x–ray exposure is taken. Release the 2nd trigger button.

Note: The exposure time can be very short (100 ms) or very long (9 s), so be sure to hold the 2nd trigger button down constantly until the exposure is complete.

6. Develop the film and measure its optical density.

Note: The grid is not activated during this calibration mode exposure, so it is normal to see grid lines on the developed film.

7. Select **SETUP/OD_mea** on the console. Use the **NEXT** and **VALID** keys and the kV dial to enter the measured optical density value. See ”Visual Display of Parameter Values” and ”Modification of a Parameter Value or Entry of a Measurement” in Chapter 1.
8. Select **SETUP/CALC/VALID** on the console to execute the calculation. At this point, either the result is satisfactory, and the software displays ”calib end” or ”calib end (A2m)” on the console display, or, if another exposure and re–calculation are necessary, the software displays ”another film”.
   - In the latter case, press the **SETUP** key once and repeat sections 3. to 8. As many as 7 or 15 films may have to be used before ”calib end” or ”calib end (A2m)” appears on the console display following the calculation, indicating a satisfactory result.

Note: Be sure to update the amount of plexiglass on the bucky (if necessary) according to the indication on the console display.

Note: To determine the value of the parameter A2, the software may use two different algorithm depending on the value of the A0 and A1. When the message ”calib end” appears on the console display, this means that the first algorithm has been used. When the message ”calib end (A2m)” appears, this means that the second algorithm has been used.

9. Select **SETUP/SETUP/PARAM** on the console and note down the three film reciprocity law failure compensation parameters A0, A1 and A2 by rotating the kV dial.

Note: Record these three parameter values in the Job Card IST011 Calibration of LNRT parameters, once you have verified them in Section 6.7 below. They can be used in the future to avoid repeating this Job Card during installation of other Senographe's with the same screen pair. The "Installation Steering" Section explains how to perform the calibration when these parameters are known.

6.6 Set manual density correction step size

1. Ask the doctor the desired manual density correction step size (step size between 0.05 to 0.5).

   For example, if the step size is chosen to be +1.000E–1 (0.1), then, assuming that the reference optical density is 1.0, the available range of corrected optical density goes from 0.5 to 1.5 in steps of 0.1 in AEC and AOP application modes.
2. Select **SETUP/SETUP/Energ/PARAM/D_STEP/CHANGE** on the console. Use the NEXT and VALID keys and the kV dial to enter the desired manual density correction step size value. See "Visual Display of Parameter Values" and "Modification of a Parameter Value or Entry of a Measurement" in Chapter 1.

6.7 Check results.

1. If necessary, enable use of the screen pair being calibrated by selecting **SETUP/SETUP/SETUP/SETUP/SETUP/VALID/YES** on the console.
2. Perform a "CKSUM" and go to application mode.
3. Set up the following exposure configuration:
   - Mode: AEC (1–point)
   - Screen pair: Select the name of the screen pair being calibrated
   - Focal spot: **LARGE**
   - Track: **MO**
   - Filter: **MO**
   - Manual density correction: **+0**
4. Keep the Senographe in the same configuration as given in step 1. in Section 6.5.
5. Take three exposures, using the screen pair being calibrated, with the following kV and plexiglass thicknesses, measuring and noting down the optical density of the film and the mAs obtained for each one:
   - 28 kV with 4 cm of plexiglass.
   - 32 kV with 1.5 cm of plexiglass.
   - 28 kV with 5.5 cm of plexiglass.

Note: Since these exposures are taken in application mode, the grid is activated during the exposures and thus no grid lines should be visible on the developed films.

The optical density must not vary by more than 0.2 between any two of the three films. If it does, the entire calibration must be repeated.

CAUTION

Do not, under ANY CIRCUMSTANCES, attempt to ”tweak” manually any of the parameters determined by the calibration procedures in this Job Card. If the optical density is outside the above–defined tolerance, there is a reason which must be corrected; correct the problem and repeat the entire calibration. A satisfactory result MUST be obtained for this criterion before proceeding to the next criterion below.

Once the variation in optical density between the three films is satisfactory, check that the optical density of the 28kV/4 cm film is inside the tolerance of the reference optical density ±0.1 (the reference optical density was chosen step 2. in Section 6.4).

If the optical density is outside this tolerance, the reference energy must be calibrated as indicated in Job Card CAL 014 ”CALIBRATION OF REFERENCE ENERGY FOR A GIVEN SCREEN PAIR”.

To do this, perform the following sequence:

a. Perform the section entitled ”Perform calibration of reference energy.” in Job Card CAL 014 ”CALIBRATION OF REFERENCE ENERGY FOR A GIVEN SCREEN PAIR”.

Note: The reference optical density MUST be re–entered following the menu sequence given in Job Card CAL 014.

Note: For the initial calibration attempt, DO NOT use the default mAs value of +7.000E+1 (70). Instead, use the mAs value obtained above from the 28 kV/4 cm check exposure.

b. Perform the section entitled ”Check results.” in Job Card CAL 014.

6. If necessary, disable use of the screen pair being calibrated. (From application mode, select **SETUP/INSTAL/AOP/ALGO/FSC=*x*/VALID/NO** on the console.) (See CAUTION in Section 3.)
7. Perform a **”CKSUM”** and go to application mode.

Note: The strategy of AOP is automatically calculed at the end of this Job Card.

Note: To check this AOP strategy see Job Card CAL 022 ”MANUAL DETERMINATION OF AOP STRATEGY FOR A GIVEN SCREEN PAIR” step 3. in function of the mAs value obtained from the 28 kV/4 cm check exposure.

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Senographe 700T and 800T Job Card CAL 014A

Purpose: **CALIBRATION OF REFERENCE ENERGY FOR A GIVEN SCREEN PAIR**	Version No.: A Date: April 4, 2001
Time: 20 min	Personnel: 1

Note: **This procedure applies to the Senographes equiped with the "CAL007 6–parameter software", i.e., a software version lower or equal to V2.21.**

SECTION 1
SUPPLIES

Normal cassette and a supply of unexposed film of the type used in the screen pair being calibrated.

SECTION 2
TOOLS

- Densitometer.
- Sensitometer.
- Plexiglas in thickness increments of 0.5 cm (minimum Plexiglas dimensions 20 x 20 cm to insure complete coverage of the photo cell).

SECTION 3
SAFETY PRECAUTIONS

CAUTION **NEVER leave the Senographe unattended during calibration of a screen pair unless the screen pair is disabled.**

CAUTION **These procedures produce x-rays. Be sure to take appropriate precautions.**

SECTION 4
PREREQUISITES

The chronological order of AEC calibration given in Chapter 1 of the Installation Steering Guide must be strictly followed for each screen pair.

CAUTION **This Job Card is used ONLY when the three reciprocity law failure compensation parameters given (A0, A1, and A2) are correct (CAL 013 OK) and we need only to adjust the overall density.**

Note: If error messages appear during this calibration, see CAL 023—General Errors During The Calibration for explanation.

CALIBRATION

CALIBRATION OF REFERENCE ENERGY FOR A GIVEN SCREEN PAIR Job Card CAL 014A 2 of 6

SECTION 5
PREPARE THE SENOGRAPHE FOR THESE PROCEDURES AND PERFORM THE CALIBRATION.

GENERAL INSTRUCTIONS TO BE OBSERVED DURING ALL PROCEDURES GIVEN BELOW IN THIS SECTION:

- The photo cell must be in its most forward position (toward the patient) throughout the procedures in this Job Card.
- When placing Plexiglas on the bucky, the Plexiglas must always overlap the front edge (towards the patient) by about 1 cm to insure that the photo cell is fully covered.
- To avoid confusing results (for you and the software), take care to avoid putting the single–sided film upside–down in the cassette.
- Whenever optical density of a film is measured, the measurement is always relative to the film base fog level. Thus, you must null out the densitometer on the film base fog, **then** measure the **relative** density in the middle of the film.

5.1 Starting from Application Mode, change the position of the installation menu enable switch (switch B1 on generator CPU board 300PL4, see ”Accessing the Generator or Gantry Installation Mode from the Console” in Chapter 1).

Note: To access the installation menus you can select the ”PASSWD” key and compose the password (given at the training course). And press the ”SETUP” key.

Note: This must only be done if the Senographe has been switched off since the last access to **SETUP/INSTAL**

5.2 Perform Calibration Of Reference Energy

The objective is to calibrate the Senographe for correct film blackening when in AEC (1–Point) or AOP (0–Point) Mode.

1. Initialization of heater current
   a. Set the Senographe to the following configuration:
      – Mode: 2–Point.
      – Focal spot: **LARGE**
      – Track: **MO**
      – Filter: **MO**
      – 28 kV
      – mAs = 100
   b. Make the exposure.

CALIBRATION

2. Ask the doctor for the desired reference optical density (generally between 1.0 and 1.5). Starting from Application Mode, select
SETUP/INSTAL/AOP/ALGO/FSC=x/CALIB/Energ/PARAM/OD_R/CHANGE
on the console, where *x* is the screen pair indicator (A,B,C,D,E) corresponding to the screen pair being calibrated. See Job Card CAL 006 ”SCREEN PAIR SELECTION AND CONFIGURATION”. Enter the desired reference optical density by using the **NEXT** and **VALID** keys and rotating the kV dial. See ”Visual Display of Parameter Values” and ”Modification of a Parameter Value or Entry of a Measurement” in Chapter 1.
3. Perform a sensitometry test on the film being used with the screen pair being calibrated.
4. Select **SETUP/SETUP/SCALE** on the console. Rotate the kV dial until the value OD_3 is displayed on the console screen. Select **CHANGE** on the console. Enter the optical density from scale number 3 of the sensitometry test by using the **NEXT** and **VALID** keys and rotating the kV dial. See ”Visual Display of Parameter Values” and ”Modification of a Parameter Value or Entry of a Measurement” in Chapter 1.
5. Press the **SETUP** key on the console. Rotate the kV dial until the value OD_5 is displayed on the console screen. Select **CHANGE** on the console. Enter the optical density from scale number 5 of the sensitometry test by using the **NEXT** and **VALID** keys and rotating the kV dial.
6. Repeat Step 5. in Section 5.2 for OD_7, OD_9, OD_11, OD_13 and OD_15 from the sensitometry test.
7. Set up the Senographe in the following configuration:
   - Any compression paddle installed.
   - Contact (no magnification).
   - Grid installed.
   - 4 cm Plexiglas on the bucky.
8. Install the cassette loaded with fresh film corresponding to the screen pair being calibrated.
9. For an initial calibration attempt, use the default mAs value of +7.000E+1 (70) by selecting **SETUP/SETUP/SETUP/CALIB/CALIB** on the console. For subsequent calibration ”passes” (if any), follow the instructions given for entering a mAs value other than the default value.
10. Press the 2nd trigger button and hold it down. A single x–ray exposure is taken. Release the 2nd trigger button.
11. Develop the film and measure its optical density.

Note: The grid is not activated during this calibration mode exposure, so it is normal to see grid lines on the developed film.

If the optical density of the film is greater than or equal to (OD_R – 0.2), where OD_R is the desired reference optical density chosen in Step 2. in Section 5.2, enter this value by selecting **SETUP/OD_MS** and using the **NEXT** and **VALID** keys and the kV dial to enter the measured optical density value, then skip directly to Step 12. in Section 5.2 below.

CALIBRATION

If the optical density of the film is less than (OD_R – 0.2), increase the mAs value by selecting **SETUP/mAs** on the console, then entering the increased mAs value by using the NEXT and VALID keys and the kV dial. Re–load the cassette and install it in the cassette holder. Then select **SETUP/CALIB** on the console and repeat Steps 10. and 11. Section 5.2.

Note: Be careful not to press the **SETUP** key more than one time after entering the mAs value. Doing so would cause this value to revert to the default mAs value of +7.000E+1 (70).

12. Select **SETUP/CALC/VALID** on the console to execute the calculation. ”CALCUL DONE” appears on the console display.

13. Note down the following information:

- Gamma value (select **SETUP/SETUP/PARAM/GAMMA** on the console).

Note: This is not the film gamma, but another intermediate value calculated for internal use by the Senographe.

- The reference energy (select **SETUP/ENR_R** on the console).

CAUTION

Do not, under ANY CIRCUMSTANCES, attempt to ”tweak” manually the GAMMA or ENR_R parameters determined by the calibration procedures in this Job Card. If the calibration results are not satisfactory, there is a reason which must be corrected; correct the problem and repeat the entire calibration.

- The reference optical density (select **SETUP/OD_R** on the console).
- The sensitometry scale densities (select **SETUP/SCALE** on the console and rotate the kV dial to display the different values).

5.3 Set Manual Density Correction Step Size

1. Ask the doctor the desired manual density correction step size.

   For example, if the step size is chosen to be +1.000E–1 (0.1), then, assuming that the reference optical density is 1.0, the available range of corrected optical density goes from 0.5 to 1.5 in steps of 0.1 in AEC and AOP Application Modes.

2. Select **SETUP/D_STEP/CHANGE** on the console. Use the **NEXT** and **VALID** keys and the kV dial to enter the desired manual density correction step size value. See ”Visual Display of Parameter Values” and ”Modification of a Parameter Value or Entry of a Measurement” in Chapter 1.

5.4 Check Results

1. If necessary, enable use of the screen pair being calibrated by selecting **SETUP/SETUP/SETUP/SETUP/SETUP/VALID/YES** on the console.
2. Perform a "CKSUM" and go to Application Mode.
3. Set up the following exposure configuration:
   - Mode: AEC (1–Point)
   - Screen pair: Select the name of the screen pair being calibrated
   - Focal spot: **LARGE**
   - Filter: **MO**
   - Manual density correction: **+0**
   - 28 kV
   - 4 cm Plexiglas
4. Keep the Senographe in the same configuration as given in Step 7. in Section 5.2.
5. Take an exposure, using the screen pair being calibrated, note down the resulting mAs value and measure the optical density of the film.

Note: Since this exposure is taken in Application Mode, the grid is activated during the exposure and thus no grid lines should be visible on the developed film.

6. The optical density of the film must not be outside the tolerance of the reference optical density ±0.1 (the reference optical density was chosen in Step 2. in Section 5.2.). If the optical density is within this tolerance, skip directly to Step 8. in Section 5.4 below.
7. If the optical density of the film is outside this tolerance, repeat the calibration procedure, BUT USE THE MAS VALUE OBTAINED FROM THE CHECK EXPOSURE TAKEN in Step 5. in Section 5.4. To do this, perform the following sequence:
   a. Select **SETUP/INSTAL/AOP/ALGO/FSC=x/CALIB/Energ./PARAM/OD_R/CHANGE** on the console. Re–enter the desired reference optical density by using the **NEXT** and **VALID** keys and rotating the kV dial.
   b. Select **SETUP/SETUP/SETUP/CALIB/mAs** on the console and enter the resulting mAs value obtained from the check exposure taken in Step 5. in Section 5.4 by using the **NEXT** and **VALID** keys and the kV dial.

Note: If the measured optical density from the check exposure is greater (less) than the desired reference density, it is preferable to use a mAs value slightly lower (higher) than the value obtained from the check exposure.

Note: Be careful not to press the **SETUP** key more than one time after entering the mAs value. Doing so would cause this value to revert to the default mAs value.

c. Repeat Steps 7. thru 13. in Section 5.2, EXCEPT THAT in Step 9. in Section 5.2, IT WILL NOW ONLY BE NECESSARY TO SELECT **SETUP/CALIB** AND NOT **SETUP/CALIB/CALIB** ON THE CONSOLE.

Note: The greater the difference between the optical density measured during the CALIBRATION and the desired reference density, the greater the final error in optical density when in automatic exposure Application Mode.

d. Repeat all checks in Section 5.4.

CAUTION **Do not, under ANY CIRCUMSTANCES, attempt to "tweak" manually the GAMMA or ENR_R parameters determined by the calibration procedures in this Job Card. If the calibration results are not satisfactory, there is a reason which must be corrected; correct the problem and repeat the entire calibration.**

8. If you entered parameters A0, A1, and A2 manually, make the following check (otherwise go to Step 9.).

   Take two exposures using the screen pair being calibrated with the following kV and Plexiglas thickness, measuring and noting the optical density of the film and the mAs obtained for each one:

   - 32 kV with 1.5 cm of Plexiglas,
   - 28 kV with 5.5 cm of Plexiglas.

   Check the optical density value obtained with 4 cm, 1.5 cm, and 5.5 cm. It must not vary by more than 0.2 between any two of the three films. If it does:

   a. Check the reciprocity low failure compensation parameters A0, A1, and A2.
      – If the parameters are not correct, re-enter them manually as explained in Chapter 1 of the Installation Steering Guide, and perform this Job Card, CAL 014, from the beginning.
      – If the parameters are correct, check Job Card CAL 007.
      If Job Card CAL 007 does not check correct, perform the entire Job Card CAL 007 before performing Job Card CAL 014 again.

   b. If all the previous checks are correct, check the automatic film processor by making several sensitometry tests and comparing the results (see Job Card CAL 012, Section 5.2).

   c. If all the previous checks are correct, perform Job Card CAL 013.

9. If necessary, disable use of the screen pair being calibrated. (From Application Mode, select **SETUP/INSTAL/AOP/ALGO/FSC =** ***x*****/VALID/NO** on the console.) (See CAUTION in Section 3).

10. Perform a "CKSUM" and go to Application Mode.

Note: The strategy of AOP is automatically calculated at the end of this Job Card.

Note: To check this AOP strategy, see Job Card CAL 022—Manual Determination Of AOP Strategy For A Given Screen Pair, Section 5.1, Step 3, in function of the mAs value obtained from the 28 kV/4 cm check exposure.

Senographe 700T and 800T Job Card CAL 014B

Purpose: **CALIBRATION OF REFERENCE ENERGY FOR A GIVEN SCREEN PAIR**	Version No.: A Date: March 14, 2001
Time: 20 min	Personnel: 1

Note: **This procedure applies to the Senographes equiped with the "CAL007 9–parameter software", i.e., a software version higher or equal to V2.31.**

SECTION 1
SUPPLIES

Normal cassette (keep the same cassette for all the procedure) and a supply of unexposed film of the type used in the screen pair being calibrated.

SECTION 2
TOOLS

- Densitometer.
- Sensitometer.
- Plexiglas in thickness increments of 0.5 cm (minimum Plexiglas dimensions 20 x 20 cm to insure complete coverage of the photo cell).

SECTION 3
SAFETY PRECAUTIONS

CAUTION **NEVER leave the Senographe unattended during calibration of a screen pair unless the screen pair is disabled.**

CAUTION **These procedures produce x-rays. Be sure to take appropriate precautions.**

SECTION 4
PREREQUISITES

The chronological order of AEC calibration given in Chapter 1 of the Installation Steering Guide must be strictly followed for each screen pair.

CAUTION **This Job Card is used ONLY when the three reciprocity law failure compensation parameters given (A0, A1, and A2) are correct (CAL 013 OK) and we need only to adjust the overall density.**

Note: If error messages appear during this calibration, see CAL 023—General Errors During The Calibration for explanation.

CALIBRATION

CALIBRATION OF REFERENCE ENERGY FOR A GIVEN SCREEN PAIR

SECTION 5
PREPARE THE SENOGRAPHE FOR THESE PROCEDURES AND PERFORM THE CALIBRATION.

GENERAL INSTRUCTIONS TO BE OBSERVED DURING ALL PROCEDURES GIVEN BELOW IN THIS SECTION:

- The photo cell must be in **position 2** throughout the procedures in this Job Card.
- When placing Plexiglas on the bucky, the Plexiglas must always overlap the front edge (towards the patient) by about 1 cm to insure that the photo cell is fully covered.
- To avoid confusing results (for you and the software), take care to avoid putting the single–sided film upside–down in the cassette.
- Whenever optical density of a film is measured, the measurement is always relative to the film base fog level (i.e., **OD net**). Thus, you must null out the densitometer on the film base fog, **then** measure the **relative** density in the middle of the film.

5.1 Starting from Application Mode, change the position of the installation menu enable switch (switch B1 on generator CPU board 300PL4, see ”Accessing the Generator or Gantry Installation Mode from the Console” in Chapter 1).

Note: To access the installation menus you can select the ”PASSWD” key and compose the password (given at the training course). And press the ”SETUP” key.

Note: This must only be done if the Senographe has been switched off since the last access to **SETUP/INSTAL**

5.2 Perform Calibration Of Reference Energy

The objective is to calibrate the Senographe for correct film blackening when in AEC (1–Point) or AOP (0–Point) Mode.

1. Initialization of heater current
   a. Set the Senographe to the following configuration:
      – Mode: 2–Point.
      – Focal spot: **LARGE**
      – Track: **MO**
      – Filter: **MO**
      – 28 kV
      – mAs = 100
   b. Make the exposure.

2. Ask the doctor for the desired reference **optical net density** (generally between 1.2 and 1.6). Starting from Application Mode, select
   SETUP/INSTAL/AOP/ALGO/FSC=x/CALIB/Energ/PARAM/OD_R/CHANGE
   on the console, where *x* is the screen pair indicator (A,B,C,D,E) corresponding to the screen pair being calibrated. See Job Card CAL 006 ”SCREEN PAIR SELECTION AND CONFIGURATION”. Enter the desired reference optical density by using the **NEXT** and **VALID** keys and rotating the kV dial. See ”Visual Display of Parameter Values” and ”Modification of a Parameter Value or Entry of a Measurement” in Chapter 1.
3. Perform a sensitometry test on the film being used with the screen pair being calibrated.
4. Select **SETUP/SETUP/SCALE** on the console. Rotate the kV dial until the value OD_1 is displayed on the console screen. Select **CHANGE** on the console. Enter the optical density from scale number 1 of the sensitometry test by using the **NEXT** and **VALID** keys and rotating the kV dial. See ”Visual Display of Parameter Values” and ”Modification of a Parameter Value or Entry of a Measurement” in Chapter 1.

Note: All sensitometry values are **OD net values**.

5. Press the **SETUP** key on the console. Rotate the kV dial until the value OD_2 is displayed on the console screen. Select **CHANGE** on the console. Enter the optical density from scale number 2 of the sensitometry test by using the **NEXT** and **VALID** keys and rotating the kV dial.
6. Repeat Step 5. in Section 5.2 for OD_3, OD_4, OD_5, OD_6, etc..., until the step after the one higher than OD max (2.8 per default).
7. Set up the Senographe in the following configuration:
   - Any compression paddle installed.
   - Contact (no magnification).
   - Bucky with Grid installed.
   - 4 cm Plexiglas on the bucky.
8. Install the cassette loaded with fresh film corresponding to the screen pair being calibrated.
9. For an initial calibration attempt, use the default mAs value of +7.000E+1 (70) by selecting **SETUP/SETUP/SETUP/CALIB/CALIB** on the console. For subsequent calibration ”passes” (if any), follow the instructions given for entering a mAs value other than the default value.
10. Press the 2nd trigger button and hold it down. A single x–ray exposure is taken. Release the 2nd trigger button.
11. Develop the film and measure its optical density.

    If the optical density of the film is greater than or equal to (OD_R – 0.2), where OD_R is the desired reference optical density chosen in Step 2. in Section 5.2, enter this value by selecting **SETUP/OD_MS** and using the **NEXT** and **VALID** keys and the kV dial to enter the measured optical density value, then skip directly to Step 12. in Section 5.2 below.

CALIBRATION OF REFERENCE ENERGY FOR A GIVEN SCREEN PAIR

If the optical density of the film is less than (OD_R – 0.2), increase the mAs value by selecting **SETUP/mAs** on the console, then entering the increased mAs value by using the NEXT and VALID keys and the kV dial. Re–load the cassette and install it in the cassette holder. Then select **SETUP/CALIB** on the console and repeat Steps 10. and 11. Section 5.2.

Note: Be careful not to press the **SETUP** key more than one time after entering the mAs value. Doing so would cause this value to revert to the default mAs value of +7.000E+1 (70).

12. Select **SETUP/CALC/VALID** on the console to execute the calculation. ”CALCUL DONE” appears on the console display.
13. Note down the following information in the IST011B (CAL014 reference energy):

- D_BF, D_MAX, A_SENS, B_SENS and SIGMA values:
  – select **SETUP/SETUP/PARAM/MODEL/RESULT/ ...** on the console.

Note: D_BF is the Base Fog Density. D_MAX is the saturation density for the model. This value is different from the actual saturation density, as the model is optimized to be accurate for the optical density lower than D_MAX. A_SENS and B_SENS are parameters used for modeling the sensitometric curve. SIGMA is the Optical Density standard deviation, between the model and the measured points.

Note: This model is not only used for this Job Card, but also for Manual Density Correction. The Model parameters are calculated from the optical density curve and must not be modified manually.

- The reference energy (select **SETUP/ENR_R** on the console).

CAUTION

Do not, under ANY CIRCUMSTANCES, attempt to ”tweak” manually the Model or ENR_R parameters determined by the calibration procedures in this Job Card. If the calibration results are not satisfactory, there is a reason which must be corrected; correct the problem and repeat the entire calibration.

- The reference optical density (select **SETUP/OD_R** on the console).
- The sensitometry scale densities (select **SETUP/SCALE** on the console and rotate the kV dial to display the different values).

5.3 Set Manual Density Correction Step Size

1. Ask the doctor the desired manual density correction step size (step size between 0.05 to 0.5).

   For example, if the step size is chosen to be +1.000E–1 (0.1), then, assuming that the reference optical density is 1.0, the available range of corrected optical density goes from 0.5 to 1.5 in steps of 0.1 in AEC and AOP Application Modes.
2. Select **SETUP/D_STEP/CHANGE** on the console. Use the **NEXT** and **VALID** keys and the kV dial to enter the desired manual density correction step size value. See ”Visual Display of Parameter Values” and ”Modification of a Parameter Value or Entry of a Measurement” in Chapter 1.

5.4 Check Results

1. If necessary, enable use of the screen pair being calibrated by selecting **SETUP/SETUP/SETUP/SETUP/SETUP/VALID/YES** on the console.
2. Perform a ”CKSUM” and go to Application Mode.
3. Set up the following exposure configuration:
   - Mode: AEC (1–Point)
   - Screen pair: Select the name of the screen pair being calibrated
   - Focal spot: **LARGE**
   - Filter: **MO**
   - Manual density correction: **+0**
   - 28 kV
   - 4 cm Plexiglas
4. Keep the Senographe in the same configuration as given in Step 7. in Section 5.2.
5. Take an exposure, using the screen pair being calibrated, note down the resulting mAs value and measure the optical density of the film.

Note: Since this exposure is taken in Application Mode, the grid is activated during the exposure and thus no grid lines should be visible on the developed film.

6. The optical density of the film must not be outside the tolerance of the reference optical density ±0.1 (the reference optical density was chosen in Step 2. in Section 5.2.). If the optical density is within this tolerance, skip directly to Step 8. in Section 5.4 below.
7. If the optical density of the film is outside this tolerance, repeat the calibration procedure, BUT USE THE MAS VALUE OBTAINED FROM THE CHECK EXPOSURE TAKEN in Step 5. in Section 5.4. To do this, perform the following sequence:
   a. Select **SETUP/INSTAL/AOP/ALGO/FSC=x/CALIB/Energ./PARAM/OD_R/CHANGE** on the console. Re–enter the desired reference optical density by using the **NEXT** and **VALID** keys and rotating the kV dial.
   b. Select **SETUP/SETUP/SETUP/CALIB/mAs** on the console and enter the resulting mAs value obtained from the check exposure taken in Step 5. in Section 5.4 by using the **NEXT** and **VALID** keys and the kV dial.

Note: If the measured optical density from the check exposure is greater (less) than the desired reference density, it is preferable to use a mAs value slightly lower (higher) than the value obtained from the check exposure.

Note: Be careful not to press the **SETUP** key more than one time after entering the mAs value. Doing so would cause this value to revert to the default mAs value.

CALIBRATION

c. Repeat Steps 7. thru 13. in Section 5.2, EXCEPT THAT in Step 9. in Section 5.2, IT WILL NOW ONLY BE NECESSARY TO SELECT **SETUP/CALIB** AND NOT **SETUP/SETUP/CALIB/CALIB** ON THE CONSOLE.

Note: The greater the difference between the optical density measured during the CALIBRATION and the desired reference density, the greater the final error in optical density when in automatic exposure Application Mode.

d. Repeat all checks in Section 5.4.

CAUTION

Do not, under ANY CIRCUMSTANCES, attempt to "tweak" manually the MODEL parameters or ENR_R parameters determined by the calibration procedures in this Job Card. If the calibration results are not satisfactory, there is a reason which must be corrected; correct the problem and repeat the entire calibration.

8. If you entered parameters A0, A1, and A2 manually, make the following check (otherwise go to Step 9.).

   Take two exposures using the screen pair being calibrated with the following kV and Plexiglas thickness, measuring and noting the optical density of the film and the mAs obtained for each one:

   - 32 kV with 1.5 cm of Plexiglas,
   - 28 kV with 5.5 cm of Plexiglas.

   Check the optical density value obtained with 4 cm, 1.5 cm, and 5.5 cm. It must not vary by more than 0.2 between any two of the three films. If it does:

   a. Check the reciprocity law failure compensation parameters A0, A1, and A2.
      – If the parameters are not correct, re-enter them manually as explained in Chapter 1 of the Installation Steering Guide, and perform this Job Card, CAL 014, from the beginning.
      – If the parameters are correct, check Job Card CAL 007.
      If Job Card CAL 007 does not check correct, perform the entire Job Card CAL 007 before performing Job Card CAL 014 again.

   b. If all the previous checks are correct, check the automatic film processor by making several sensitometry tests and comparing the results (see Job Card CAL 012, Section 5.2).

   c. If all the previous checks are correct, perform Job Card CAL 013.

9. If necessary, disable use of the screen pair being calibrated. (From Application Mode, select **SETUP/INSTAL/AOP/ALGO/FSC =** ***x*****/VALID/NO** on the console.) (See CAUTION in Section 3).

10. Perform a "CKSUM" and go to Application Mode.

Note: The strategy of AOP is automatically calculated at the end of this Job Card.

Note: To check this AOP strategy, see Job Card CAL 022—Manual Determination Of AOP Strategy For A Given Screen Pair, Section 5.1, Step 3, in function of the mAs value obtained from the 28 kV/4 cm check exposure.

Senographe 700T and 800T Job Card CAL 015 1 of 4

Purpose: **CHECKING THE MAINS SUPPLY FOR A FULL POWER USE**	Version No.: A Date: Dec. 18, 1995
Time: xx min	Personnel: 1

SECTION 1
SUPPLIES

None.

SECTION 2
TOOLS

Voltmeter with PEAK MIN MAX Mode (FLUKE 87).

Note: For this measurement, the FLUKE 87 voltmeter or equivalent is used in the record MIN–MAX function.

SECTION 3
SAFETY PRECAUTIONS

CAUTION

This procedure produce X–rays. Be sure to take appropriate precautions.

SECTION 4
PREREQUISITES:

SECTION 5
CHECKING THE MAINS SUPPLY FOR A FULL POWER USE OF THE SENOGRAPHE

The objective is to determine the drop of the DCBUS voltage during a full–power exposure and then to check that in the range of the mains supply used , no problem can occur due to a poor line resistance .

Note: This is not a line resistance measurement . This operation only checks that for a given mains supply, with the appropriate margin , the device can be used with maximum power : 3KW (30KV 100mA) without problem .

CALIBRATION

CHECKING THE MAINS SUPPLY FOR A FULL POWER USE Job Card CAL 015

5.1 Procedure of measurement

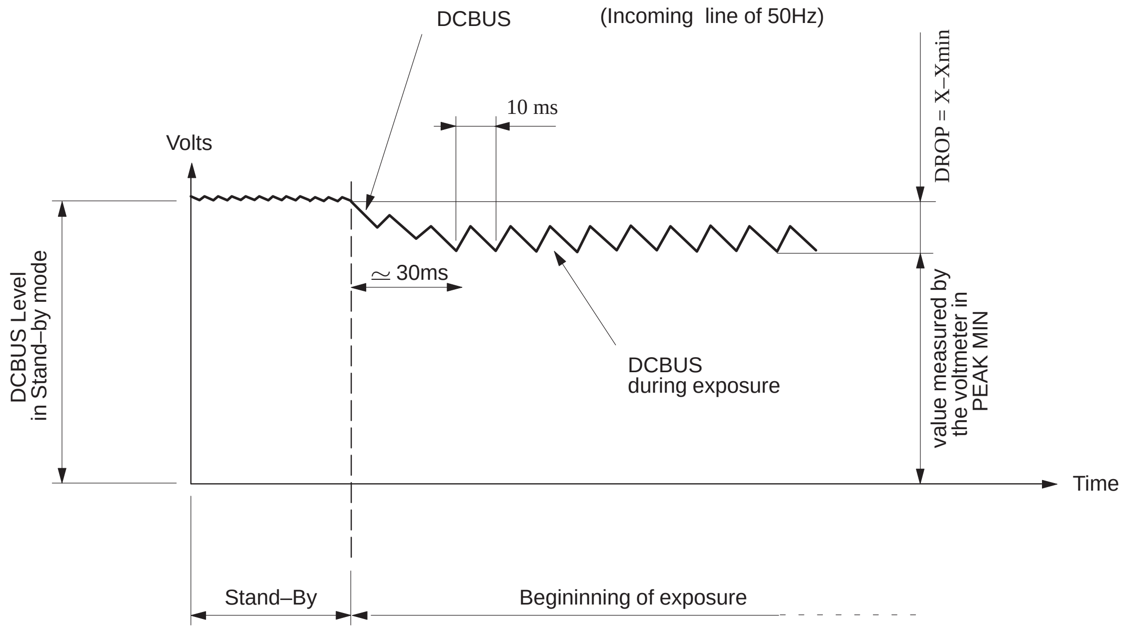
DROP MAX authorized	Minimum incoming line –10%	Incoming line nominal Value
64	180V	200V
69	187V	208V
84	198V	220V
97	207V	230V
110	216V	240V

DROP MAX authorized < (Minimum incoming line x $\sqrt{2}$) – 195V

Note: 195v being DCBUS MIN (180v) + Safety Margin (15V)

5.1.1 DCBUS measurement in stand–by mode and during exposure (see illustration 1):

ILLUSTRATION 1
EVOLUTION OF THE DCBUS DURING AN EXPOSURE



CALIBRATION

CHECKING THE MAINS SUPPLY FOR A FULL POWER USE Job Card CAL 015 3 of 4

1. Turn off the Senographe and open mains fuse disconnector and 300S1.
2. Connect the voltmeter on **+CAPA** and **–CAPA** on the PowerSupply Board 300PL9.
3. Switch on the Senographe
4. Note the value **X** of the DCBUS in stand–by mode

5.1.2 Measurement of the drop of the DCBUS during a full–power exposure: Xmin

1. Press the button MINMAX on the voltmeter, then the button PEAK MIN MAX and at last again the button MINMAX. The voltmeter is now in Recording mode 1ms .
2. Set up the following parameters
   - Focal spot: **LARGE**
   - 30kV
   - 100mAs
3. Take the exposure and note the MIN DCBUS value: Xmin, given by the voltmeter.

5.1.3 Check the results and decision.

1. Calculate Actual Drop = **X – Xmin**

   If actual drop measured is greater than DROP MAX authorized given in the Table1, the resistance must be checked by appropriate electrician.

   The power installation must be modified if the line resistance found does not meet the requirements. Refer to the PIM.

CALIBRATION

Blank page.

Senographe 700T and 800T Job Card CAL 016 1 of 4

Purpose: **CALIBRATION OF X–RAY TUBE mA MEASUREMENT**	Version No.: A Date: Dec. 18, 1995
Time: x h xx min	Personnel: 1

SECTION 1
SUPPLIES

None.

SECTION 2
TOOLS

Milliampmeter.

Note: When using the Fluke 87, you must use the **RANGE** button to select MANUAL range for VDC measurement.

SECTION 3
SAFETY PRECAUTIONS

None.

SECTION 4
PREREQUISITES

Note: In case of error messages during this calibration, see CAL 023 ”GENERAL ERRORS DURING THE CALIBRATION” for explanations.

SECTION 5
CALIBRATION OF X–RAY TUBE MA MEASUREMENT

The objective is to determine the scale factor F/mA between the X–ray tube mA measurement input to the software and the real X–ray tube mA value.

DEFAULT PARAMETER VALUE IS F/mA = +1.000E+3 (1000) Hz/mA

CAUTION

DO NOT touch potentiometer R1 on high voltage measure board 300PL15 at any point in this Job Card.

5.1 Prepare the Senographe for this calibration procedure

1. Turn off the Senographe.
2. Remove the strap SK1 of 300PL8 High Voltage Control board (see illustration 1).
3. Connect the digital milliampmeter between pin TP38 and TP39 of 300PL8 High Voltage Control board. Set the milliammeter to 100 mA DC scale.
4. Turn on the Senographe.
5. Change the position of the installation menu enable switch (switch 8 of B1 on 300PL4 CPU board, see ”Accessing the Different Installation Menus in the Tree Structure” in Chapter 1).

Note: To access to the installation menus you can select the ”PASSWD” key and compose the password (given at the training course). And press the ”SETUP” key.

5.2 Perform the calibration procedure

6. Starting from application mode, select **SETUP/INSTAL/GENE/mA_meas/CALIB/CALIB** on the console. Read and note down the value measured on the milliammeter. Select **MEASUR** on the console. (This request for a measurement of x–ray tube current is needed by the calibration software, but the value displayed on the console at this point is of no importance to the service engineer).
7. Select **SETUP/I_MEAS** on the console. Enter the value of current (in milliamperes) read from the milliammeter by using the NEXT and VALID keys and rotating the kV dial. See ”Visual Display of Parameter Values” and ”Modification of a Parameter Value or Entry of a Measurement” in Chapter 1.

Note: Only values between + 4.400E + 1 (44) and + 6.600E + 1 (66) mA are accepted by the calibration software. An error message appears on the console display if a value outside of this range is entered.

8. Select **SETUP/CALCUL/VALID** on the console to execute the calculation. If the calculated F/mA value is between +8.50000E + 2 and 1.150E + 3, ”ma calib END” appears on the console display. Otherwise, an error message appears, indicating the presence of a problem.

5.3 Prepare the Senographe for checking procedure

1. Select **SETUP/CALIB** on the console. Read and note down the value measured on the milliammeter. Select **MEASUR** on the console. Verify that the measurement on the console display now corresponds to the value read on the milliampmeter ±400 μA ± milliampmeter error. DO NOT ENTER THIS MEASURED VALUE.
2. Perform a ”CKSUM” and return to application mode.
3. Turn off the Senographe.
4. Connect the digital milliammeter between pin TP40 and TP39 of generator of 300PL8 High Voltage Control board (see Illustration 1). Set the milliampmeter to 200 mA DC scale.
5. Turn on the Senographe.
6. Change the position of the installation menu enable switch (switch 8 of B1 on 300PL4 CPU board, see ”Accessing the Different Installation Menus in the Tree Structure” in Chapter 1).

Note: To access to the installation menus you can select the ”PASSWD” key and compose the password (given at the training course). And press the ”SETUP” key.

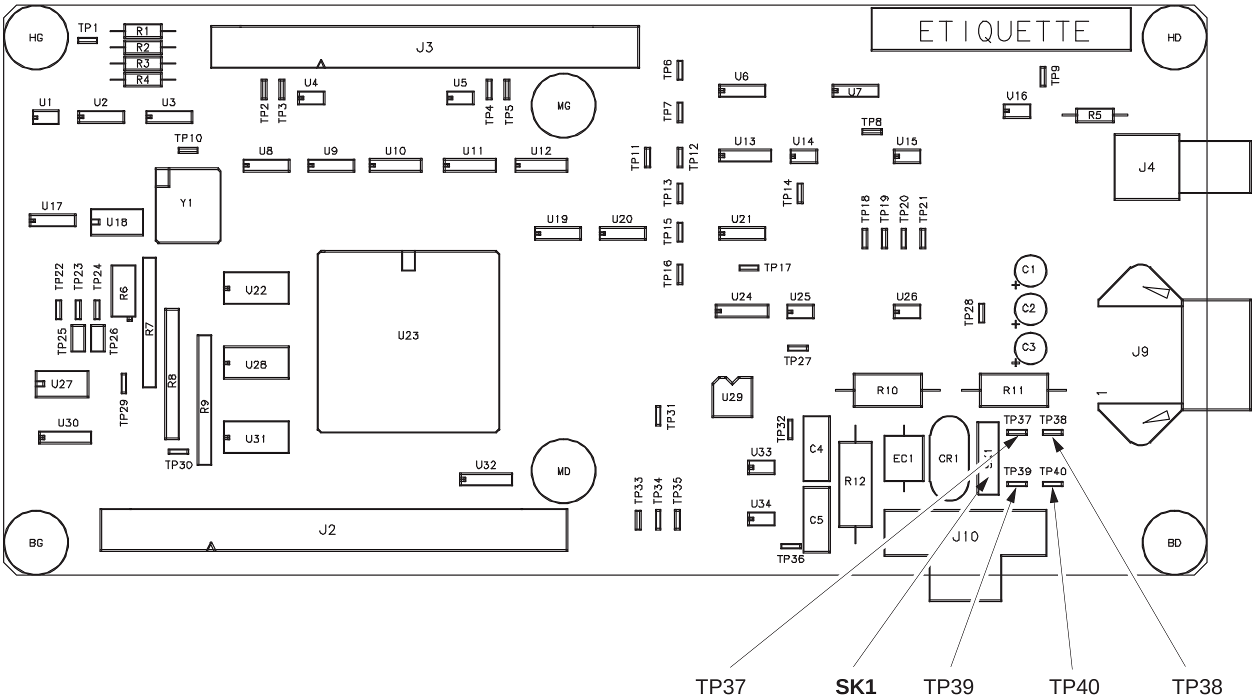
5.4 Check results

1. Starting from application mode, select **SETUP/INSTAL/GENE/mA_meas/CALIB/CALIB** on the console. Read and note down the value measured on the milliampmeter (the current shoud be approximately 95 mA). Select **MEASUR** on the console. Verify that the difference between the measurement on the console display and the value read on the milliampmeter is less than 2.4 mA. DO NOT ENTER THIS MEASURED VALUE.
2. Select **SETUP/SETUP/PARAM** on the console and note down the displayed value of F/mA.
3. Return to application mode.
4. Turn off the Senographe.
5. Disconnect the milliampmeter and **replace the strap SK1 located close to pin TP37 and TP39 of 300PL8 High Voltage Control board.** (see Illustration1).

CALIBRATION OF X–RAY TUBE mA MEASUREMENT

Job Card CAL 016 4 of 4

ILLUSTRATION 1
300PL8 HIGH VOLTAGE CONTROL BOARD



Purpose: **CALIBRATION OF kV SCALE FACTOR**	Version No.: A Date: Dec. 18, 1995
Time: x h xx min	Personnel: 1

SECTION 1
SUPPLIES

None.

SECTION 2
TOOLS

RMI 232 kV peak meter is recommended. Keithley 35080 can be used when RMI 232 is not available on site.

Note: If a calibration curve is attached to the meter (obtained during periodic recalibration of the meter for exemple), this curve must be used to correct the direct reading of the meter, all along this Job Card (calibration and check).

SECTION 3
SAFETY PRECAUTIONS

CAUTION

These procedures produce x–rays. Be sure to take appropriate precautions.

SECTION 4
PREREQUISITES

The following procedures must have been performed in the following order:

Note: In case of error messages during this calibration, see CAL 023 ”GENERAL ERRORS DURING THE CALIBRATION” for explanations.

CALIBRATION

SECTION 5
CALIBRATION OF KV SCALE FACTOR

The objective is to determine the scale factor G and offset VOF between the X–ray tube kV command from the software and the real kV value obtained.

DEFAULT PARAMETER VALUES ARE G = + 6.554E + 1 (65.54) and VOF = + 0.000E + 0 (0.0)

CAUTION

DO NOT touch potentiometer R1 on High Voltage Measure Board 300PL15 at any point in this Job Card (on the tank).

5.1 Prepare the Senographe for this calibration procedure

1. Set up the Senographe in the following configuration:
   - No compression paddle.
   - Maximum magnification mode, 1.75 (the purpose here is simply to reduce the distance between the RMI kV peak meter and the X–ray source – see RMI or keithley documentation for minimum acceptable distance from X–ray source, if any).

Note: It's not usefull to change the collimator.

2. Place peak meter on the magnification device or cassette holder. Turn it on and set it to the "MO/MO" position.

Note: For RMI 232, set the waveform selector to "CP" (constant potential).

3. Use the Senographe light centering device to center the kV peak meter target with the X–ray zone.

Note: Ensure proper Anode–Cathode alignment of meter to eliminate heel effect.

4. Starting from application mode, change the position of the installation menu enable switch (switch B1 on generator CPU board 300PL4).

Note: To acces to the installation menus you can select the "PASSWD" key and compose the password (given at the training course). And press the "SETUP" key.

CALIBRATION OF kV SCALE FACTOR

Job Card CAL 017

5.2 Perform the calibration procedure

1. Select **SETUP/INSTAL/GENE/KV/CALIB/1st pt/CALIB** on the console.

Note: By default, the kV command value sent by the software for this 1st point is 25 kV.

2. Press the 2nd trigger button and hold it down. A single 1–second exposure is taken. ”CALIBRATION END” appears on the console display. Release the 2nd trigger button. Note down the kV value displayed on the kV peak meter.

Note: If for some reason, this exposure has to be repeated select **SETUP/CALIB** on the console before pressing the 2nd trigger button again.

3. Select **SETUP/kV_M** on the console. Enter the kV value read from the peak meter by using the **NEXT** and **VALID** keys and rotating the kV dial. See ”Visual Display of Parameter Values” and ”Modification of a Parameter Value or Entry of a Measurement” in Chapter 1.

Note: If the measured kV value is outside the range + 2.500E + 1 (25) kV ± 15%, this indicates either a faulty kV measurement or a hardware failure, and the calibration software will not accept the entry of such a value.

4. Select **SETUP/SETUP/2nd pt/CALIB** on the console.

Note: By default, the kV command value sent by the software for this 2nd point is 35 kV. Due to DMR software, the Mo filter remains selected.

5. Press the 2nd trigger button and hold it down. A single 1–second exposure is taken. ”CALIBRATION END” appears on the console display. Release the 2nd trigger button. Note down the kV value displayed on the kV peak meter.

Note: If for some reason, this exposure has to be repeated select **SETUP/CALIB** on the console before pressing the 2nd trigger button again.

6. Select **SETUP/kV_M** on the console. Enter the kV value read from the kV peak meter by using the **NEXT** and **VALID** keys and rotating the kV dial. See ”Visual Display of Parameter Values” and ”Modification of a Parameter Value or Entry of a Measurement” in Chapter 1.

Note: If the measured kV value is outside the range + 3.500E + 1 (35) kV ± 15%, this indicates either a faulty kV measurement or a hardware failure, and the calibration software will not accept the entry of such a value.

7. Select **SETUP/SETUP/calcul/VALID** on the console to execute the calculation. Normally, ”KV CALIB END” appears on the console display. If ”OUT OF RANGE” appears on the console display, this indicates either faulty kV measurement(s) in the steps above, or a hardware failure.

CALIBRATION OF kV SCALE FACTOR

Job Card CAL 017

5.3 Check results

1. Leave the Senographe set up as given step 1. in section 5.1 , with the kV peak meter on the cassette holder, and select **SETUP/1st pt/CALIB** on the console.
2. Press the 2nd trigger button and hold it down. A single 1–second exposure is taken. ”CALIBRATION END” appears on the console display. Release the 2nd trigger button. Note down the kV value displayed on the kV peak meter. DO NOT ENTER THIS MEASURED VALUE.
3. The kV value read on the kV peak meter should be 25 kV ± 0.3 kV.

Note: The generator kVp accuracy is ± 1% (one per cent) when measured just after a calibration.

4. Select **SETUP/SETUP/2nd pt/CALIB** on the console.
5. Press the 2nd trigger button and hold it down. A single 1–second exposure is taken. ”CALIBRATION END” appears on the console display. Release the 2nd trigger button. Note down the kV value displayed on the kV peak meter. **DO NOT ENTER THIS MEASURED VALUE.**
6. The kV value read on the kV peak meter should be 35 kV ± 0.4 kV.

Note: The generator kVp accuracy is ± 1% when measured just after a calibration.

7. Select **SETUP/SETUP/SETUP/PARAM** on the console. Note down the displayed values of G and VOF by rotating the kV dial.
8. Perform a ”CKSUM” and return to application mode.

Senographe 700T and 800T — Job Card CAL 018

Purpose: **TEST FOR ABSENCE OF GRID LINES ON EXPOSED FILM**	Version No.: Date: Dec. 18, 1995
Time: 10 min	Personnel:

SECTION 1
SUPPLIES

Film and cassette of type and size(s) used by the customer on the Senographe (18X24 mm, plus 24X30 mm if this option is chosen by the customer).

SECTION 2
TOOLS

- Four sheets of plexiglass in thickness of 1 cm (minimum plexiglass dimensions 15 x 15 cm)
- Two sheets of plexiglass in thickness of 0.5 cm (minimum plexiglass dimensions 15 x 15 cm)
- Densitometer.

SECTION 3
SAFETY PRECAUTIONS

CAUTION **This procedure produres x–rays. Be sure to take appropriate precautions.**

SECTION 4
PREREQUISITES

The generator have to be calibrated, AEC calibration is not necessary.

Note: In case of error messages during this calibration, see CAL 023 ”GENERAL ERRORS DURING THE CALIBRATION” for explanations.

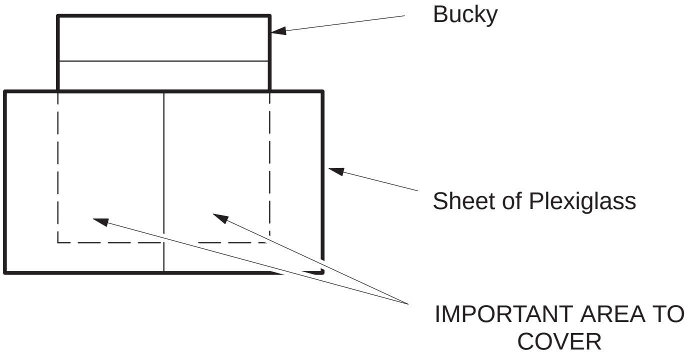
SECTION 5
TEST FOR ABSENCE OF GRID LINES ON EXPOSED FILM

The objective is to test for correct grid movement by taking a exposure and examining the developed film for grid lines.

5.1 General instructions to be observed during all procedures in this Job Card

1. The sheets of plexiglass have to be arranged on all surface of the film in order to verify that there are no signs of grid lines anywhere on the exposed area of the film, in particular in the areas shown on Illustration 1).

ILLUSTRATION 1



5.2 Perform the test for absence of grid lines on exposed film

1. Set up the Senographe with the Bucky being tested and compression paddle installed.
2. Set up the examination arm angle at 0 degree.
3. Disable ”Automatic Decompression following an exposure” by selecting **SETUP/MEDICAL/DECOMP/**NO and returning to application mode.
4. Set up the following exposure:
   - Manual mode (2 points).
   - Focal spot: **LARGE** (Collimator LF corresponding to the bucky).
   - Filter: **MO** (Selectable only with 800T).
   - 28 mAs
5. Place 2 cm of plexiglass on the bucky and put the compression paddle in contact with the plexi.
6. Select 22kV.

TEST FOR ABSENCE OF GRID LINES ON EXPOSED FILM

Job Card CAL 018

7. Load the cassette with a fresh undeveloped film that corresponds to the screen pair being used for the test and install the cassette in the bucky.
8. Take an exposure. Develop the film and measure its optical density.
   - If the optical density is between 1.0 and 1.6, as measured relative to go directly to step 9. in Section 5.2.
   - If the optical density is less than 1.0 increase the kV. Change the plexiglass using the values from Table 1 and go to step 7. in Section 5.2.
   - If the optical density is greater then 1.6, and the kV is greater than 22, decrease the kV by 1 kV. Change the plexiglass using the values from Table1 and go to step 7. in Section 5.2.
   - If the optical density is greater then 1.6, and the kV = 22, add 0.5cm of plexiglass and go to step 7. in Section 5.2.
9. Study the developed film on a light screen with jeweler’s loop. Verify that there are no signs of grid lines anywhere on the exposed area of the film. Visible grid lines indicate a problem in the grid drive train. If there are visible grid lines, trouble shoot the grid and the Bucky.
10. Using the same kV and plexiglass, repeat the test (7. to 9.) with the examination arm angle at +45 degrees and – 45 degrees.
11. Enable ”Automatic Decompression following an exposure” by selecting **SETUP/MEDICAL/DECOMP/**YES, if this parameter was ”YES” before beginning this Job Card.

TABLE 1

kV	THICKNESS
22	2 cm
23	1.5 cm
24	1 cm
25	1 cm
26	0.5 cm
27	0.5 cm
28	0.5 cm

TEST FOR ABSENCE OF GRID LINES ON EXPOSED FILM	Job Card CAL 018	4 of 4

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Senographe 700T and 800T Job Card CAL 019 1 of 4

Purpose: **CALIBRATION OF COMPRESSION FORCE DETECTOR**	Version No.: A Date: Dec. 18, 1995
Time: x h xx min	Personnel: 1

SECTION 1
SUPPLIES

None.

SECTION 2
TOOLS

- Calibrated force detector capable of measuring compression force between the compression paddle and the cassette holder, required accuracy ±0.5 daN (Mammo compression scale PN: 46–194427P407 or equivalent).
- One 3 kg weight whose dimensions allow it to be placed on top of the compression paddle.

SECTION 3
SAFETY PRECAUTIONS

None.

SECTION 4
PREREQUISITES

None.

SECTION 5
ADVANCE PREPARATION AND INFORMATION

NEVER go up in the menu structure higher than indicated in the procedure being performed. Doing so will reset stored intermediate values and ruin the calibration.

If a power shutdown occurs during this calibration, a message ERROR CHECKSUM appears on the control panel when the power is ON again: YOU MUST execute again the Job Card CAL 019 and CAL 020 ”MINIMUM COMPRESSION/DECOMPRESSION FORCE TESTS”.

Note: In case of error messages during this calibration, see CAL 023 ”GENERAL ERRORS DURING THE CALIBRATION” for explanations.

Note: A vibration noise in the compression motor is normal during this calibration because the motor current is forced to 100% by software.

CALIBRATION

SECTION 6
CALIBRATION OF COMPRESSION FORCE DETECTOR

The objective is to calibrate the compression force detector, by measuring and entering 11 different values of compression force.

6.1 Prepare the Senographe for the tests.

Starting from application mode, change the position of the installation menu enable switch (switch 8 of B1 on 300PL4 CPU board, see ”Accessing the Different Installation Menus in the Tree Structure” in Chapter 1).

Note: To access to the installation menus you can select the ”PASSWD” key and compose the password (given at the training course). And press the ”SETUP” key.

Note: This must only be done if the Senographe has been switched off since the last access to **SETUP/INSTAL**

6.2 Perform the calibration.

1. Set up the Senographe in the following configuration:
   - Arm rotation at exactly 0°.
   - Contact mode.
   - Compression paddle 18 x 24.
   - Cassette holder 18 x 24.
2. Remove the shoulder guard.
3. Raise the compression paddle and place the force detector on the cassette holder.
4. Starting from application mode, select **SETUP/INSTAL/ARM/COMP/FORCE/CALIB/MEASURE** on the console.

WARNING

DON’T MAKE ANY ROTATION OR COMPRESSION MOVEMENT WITH THE 3 KG WEIGHT ON TOP OF PADDLE. IF YOU DO THAT, GO BACK TO APPLICATION MENU, TURN THE MACHINE OFF AND REPEAT THE CALIBRATION.

5. With the compression paddle completely out of contact (i.e. not in touch with the cassette holder), put the 3 kg weight on top of the paddle and press the ”**–3daN**” key on the console. The message ”–3” appears on the display.
6. Remove the 3 kg weight and, with the paddle in the same position, press the ”**0daN**” key on the console. The message ”0” appears on the display.

7. Zero the force detector.
8. Lower the compression paddle into contact with the force detector. Using the compression fine–adjustment knob, adjust the compression to exactly 3 daN on the force detector.
9. Press the ”**3 daN**” key on the console. The message ”3” appears on the display.
10. Still using the compression fine–adjustment knob, increase the compression to 6 daN on the force detector.
11. Press the ”**6 daN**” key on the console. The message ”6” appears on the display.
12. Press the ”**1–>2**” key on the console**.**
13. Continue this process for 9 daN, 12 daN, 15 daN and 18 daN by adjusting the compression and pressing the corresponding key on the console.
14. Press the ”**2–>3**” key on the console**.**
15. Continue the process for 21 daN, 24 daN and 27 daN by adjusting the compression and pressing the corresponding key on the console.
16. Decompress until the force is less then 3 daN.
17. Select **SETUP/CALCUL** on the console. This executes the calculation of the new force detector calibration parameters. The message ”END of CALCUL” appears on console.
18. Perform a ”CKSUM” and return to application mode.
19. Request a total decompression of the compression paddle.
20. Press Rotation Switch (it is not necessary to make rotation movement).
21. Request a total compression movement: Now the offset force calculation is finished.

6.3 Check the results.

1. Select 10 kg force in the **SETUP/MEDICAL/FORCE** menu.
2. With the arm at 0° (i.e. x–ray tube above the cassette holder), bring the compression paddle into contact once again with the force detector. Increase the compression, **using manual adjustment slowly** until maximum force is reached (i.e. compression cannot be further increased). Read the force detector measurement and check that it is within ±1 daN of the maximum compression force chosen in the **SETUP/MEDICAL/FORCE** menu.
3. Repeat the above check with the arm rotated to 180° (i.e. x–ray tube below the cassette holder). Read the force detector measurement, then add the weight of the force detector (2.6 kg for mammo compression scale PN: 46–194427P407) at this measure, and check that the result is within ±1 daN of the maximum compression force chosen in the **SETUP/MEDICAL/FORCE** menu.

Note: If you can‘t achieve the check, perform this Job CAL 019 again and go back to the check.

6.4 Return the Senographe to its normal state.

1. If you’re turning the Senographe back over to the user at this point, turn the Senographe off, then on again.

Senographe 700T and 800T Job Card CAL 020

Purpose: **MINIMUM COMPRESSION/DECOMPRESSION FORCE TESTS**	Version No.: A Date: Dec. 18, 1995
Time: x h xx min	Personnel: 1

SECTION 1
SUPPLIES

None.

SECTION 2
TOOLS

- Calibrated force detector capable of measuring compression force between the compression paddle and the cassette holder, required accuracy ±0.5 daN (Mammo compression scale PN: 46–194427P407 or equivalent).
- One 3 kg weight whose dimensions allow it to be placed on top of the compression paddle.

SECTION 3
SAFETY PRECAUTIONS

None.

SECTION 4
PREREQUISITES

Job Card CAl 019 ”CALIBRATION OF COMPRESSION FORCE DETECTOR”.

Note: In case of error messages during this calibration, see CAL 023 ”GENERAL ERRORS DURING THE CALIBRATION” for explanations.

SECTION 5
MINIMUM COMPRESSION/ DECOMPRESSION FORCE TESTS

The objectives are:

- To calibrate the paddle drive motor current limit in order to be able to reach a compression force of 22 daN when the arm is rotated by 180°.
- To check that the compression force can not reach 30 daN.
- To check that a decompression force of at least 4 daN can be reached when the arm is at 0° with the paddle drive motor current limit value set to 40% of the motor’s maximum current rating. (This guarantees that the compression paddle will rise and stay up when decompression is requested).

If a power shutdown occurs during this calibration, a message ERROR CHECKSUM appears on the control panel when the power is ON again: YOU MUST execute again the Job Card CAL 019 and CAL 020.

5.1 Prepare the Senographe for the tests

1. Starting from application mode, change the position of the installation menu enable switch (switch 8 of B1 on 300PL4 CPU board, see ”Accessing the Different Installation Menus in the Tree Structure” in Chapter 1).

Note: This must only be done if the Senographe has been switched off since the last access to **SETUP/INSTAL**

Note: To access to the installation menus you can select the ”PASSWD” key and compose the password (given at the training course). And press the ”SETUP” key.

2. Set up the Senographe in the following configuration:
   - Contact mode.
   - Compression paddle 18 x 24.
   - Cassette holder 18 x 24.
3. Remove the shoulder guard.
4. Starting from application mode, select **SETUP/INSTAL/ARM/COMP/LIMIT/LIMIT_IC** on the console. Use the ”+” and ”–” keys on the console to set the maximum motor current value (in compression mode) to 80%. Enter this value with the **VALID** key on the console.
5. Select **SETUP/LIMIT_OC** on the console. Use the ”+” and ”–” keys on the console to set the maximum motor current value (in decompression mode) to 40%. Enter this value with the **VALID** key on the console.

5.2 Perform ”in compression” motor current value

1. Stay in the same calibration menu as used step 4. and 5. in Section 5.1 above (i.e. starting from application mode, select **SETUP/INSTAL/ARM/COMP/LIMIT** on the console).
2. Set up the Senographe in contact mode with a compression paddle installed.
3. Rotate the arm to 180° (i.e. x–ray tube below the cassette holder).
4. Zero the mammo compression scale.
5. Put the mammo compression scale on the compression paddle.
6. Bring the compression paddle into contact with the cassette holder.

MINIMUM COMPRESSION/DECOMPRESSION FORCE TESTS

CAUTION

Be ready to catch the mammo compression scale if the compression paddle releases and falls towards the tube housing before to perform the next step.

7. Increase compression and read the force detector measurement, at which you must add the weight of the force detector (2.6 kg for mammo compression scale PN: 46–194427P407). The result of this measure must reach 22 daN without the compression paddle releasing.
8. If a force value of more than 22 daN can be reached without the compression paddle releasing, repeat step 4. in Section 5.1. above, but decrease the maximum “in compression” motor current value by 1%, or more then try again to reach 22 daN. Continue decreasing the maximum ”in compression” motor current value in step of 1% or more, if necessary, until 22 daN can not be reached without the compression paddle releasing and go to the step 10.
9. If the compression paddle releases before a force of 22 daN is reached, repeat step 4. in Section 5.1 above, but increase the maximum ”in compression” motor current value by 1% or more in the **SETUP/INSTAL/ARM/COMP/UNIT/LIMIT_IC** menu, then try again to reach 22 daN. Continue increasing the maximum ”in compression” motor current value in steps of 1% or more, if necessary, until 22 daN can be reached.
10. Remove the mammo compression scale.
11. Request a total decompression of the compression paddle, using the appropriate pedal.
12. Rotate the arm to 0° (i.e. x–ray tube above the cassette holder).
13. Put the mammo compression scale on the cassette holder.
14. Zero the mammo compression scale.
15. Bring the compression paddle into contact with the cassette holder.
16. Starting from application mode, select **SETUP/INSTAL/ARM/COMP/LIMIT** on the console (i.e. stay in the same calibration menu as used to steps 4. to 5. in Section 5.1
17. Increase compression and check with the force detector that the compression paddle releases before the value of 30 daN can be reached. If the compression paddle released after 30 daN, decrease the maximum ”in compression” motor current value by step of 1% in the **SETUP/INSTAL/ARM/COMP/LIMIT/LIMIT_IC** menu on the console and repeat step 16. in Section 5.2.

    If you had modified the maximum ”in compression” motor current in the step 17. in Section 5.2, then go to Section 5.3. In the other case go directly to Section 5.4.

Note: The maximum force value must be less than 30 daN in any case.

CALIBRATION

MINIMUM COMPRESSION/DECOMPRESSION FORCE TESTS

5.3 Check ”in compression” motor current value

1. Request a total decompression of the compression paddle.
2. Rotate the arm to 180° (i.e. x–ray tube below the cassette holder).
3. Put the mammo compression scale on the compression paddle.
4. Bring the compression into contact with the cassette holder.
5. Increase compression and read the force detector measurement, at which you must add the weight of the force detector (2.6 kg for mammo compression scale PN: 46–194427P407). The result of this measure must reach 22 daN without the compression paddle releasing. If it is not the case, repeat Section 5.2.

5.4 Perform ”out of compression” motor current value

1. Request a total decompression of the compression paddle.
2. Rotate the arm to 0° (i.e. x–ray tube above the cassette holder).
3. Bring the compression paddle into contact with the cassette holder.
4. Decompress more than 2 cm.
5. Place the 3 kg weight on top of the compression paddle.

WARNING

WHEN THE WEIGHT IS INSTALLED ON TOP OF COMPRESSION PADDLE, DON’T MAKE ANY ROTATION MOVEMENT.

6. Request a total decompression of the compression paddle using the appropriate pedal. The compression paddle must rise smoothly to its home position.

WARNING

STOP DECOMPRESSION MOVEMENT AT 5 CM BEFORE REACHING THE COMPRESSION SPRING AT THE TOP OF THE EXAMINATION ARM, BECAUSE THERE IS NO CONTROL OF THE FORCE LIMIT IN THIS CALIBRATION.

7. If the compression paddle slips or releases, first check that the compression paddle drive belt is not slipping. If it is slipping, adjust or replace the belt. Otherwise, repeat step 5. in Section 5.1 above, but increase the maximum ”out of compression” motor current value by 1% or more in the **SETUP/INSTAL/ARM/COMP/LIMIT/LIMIT_OC** menu, then try again for a total decompression. Continue increasing the maximum ”out of compression” motor current value in steps of 1% or more, if necessary, until it is possible to achieve total decompression.

Note: The maximum ”out of compression” motor current adjustment range is limited to 65%.

8. Perform a ”CKSUM” and return to application mode.

5.5 Check the ”–3 kg” force in application mode

1. Request a total decompression of the compression paddle.
2. Rotate the arm to 0° (i.e. x–ray tube above the cassette holder).
3. Bring the compression paddle into contact with the cassette holder.
4. Decompress more than 2 cm.
5. Place the 3 kg weight on top of the compression paddle.
6. Request a decompression with the pedal. The compression paddle must not rise. If the compression paddle can rise, make again the CAL 019 ”CALIBRATION OF COMPRESSION FORCE DETECTOR”.
7. If you’re turning the machine back over to the user at this point, turn the Senographe off, then back on again.

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Senographe 700T and 800T Job Card CAL 021

Purpose: **CHECKING X–RAY FILM FORMAT GEOMETRY**	Version No.: 0 Date: Dec. 18, 1995
Time: x h xx min	Personnel: 1

SECTION 1
SUPPLIES

- Normal cassette and a supply of unexposed films.
- ”Ready Pack” or (cardboard cassette(films (24x 30 format).

SECTION 2
TOOLS

- Ruler calibrated in mm (minimum lengh 30 cm).
- Pen or pencil capable of marking the surface of an x–ray film.
- Thumb tacks or push pins.

SECTION 3
SAFETY PRECAUTIONS

CAUTION

This is procedures x–rays. Be sure to take appropriate precautions.

SECTION 4
PREREQUISITES

Note: In case of error messages during this calibration, see CAL023 ”GENERAL ERRORS DURING THE CALIBRATION” for explanations.

CALIBRATION

CALIBRATION

SECTION 5
CHECKING X–RAY FILM FORMAT GEOMETRY

The objective is to verify that the exposed area on the x–ray film is within the required tolerances for the following properties:

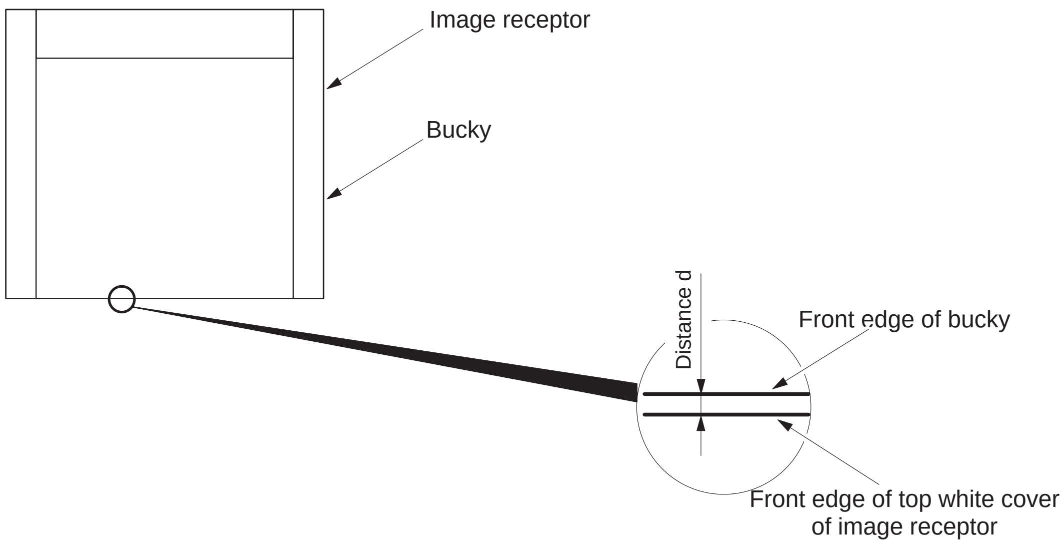
- Alignment between front edge of bucky and front edge of image receptor.
- Parallelism between front edge of compression paddle and front edge of bucky.
- Parallelism between front edge of collimator blade and front edge of bucky.
- Alignment between left edge of collimator blade and left edge of bucky.
- Alignment between front edge of collimator blade and front edge of bucky.

These checks are performed by making various geometrical measurements on an exposed film and ”cardboard cassette” or ”Ready Pack” film.

5.1 Check alignment between front edge of bucky and front edge of image receptor

1. Setup the Senographe in the following configuration:
   - Bucky 18X24.
   - No compression paddle.
2. The front edge of bucky have to be line up the front edge of the top white cover of the image receptor. See Illustration 1.

ILLUSTRATION 1



3. Use the ruler to measure carefully the distance d. See Illustration 1.

   CRITERION: The distance d must be less than 1mm.

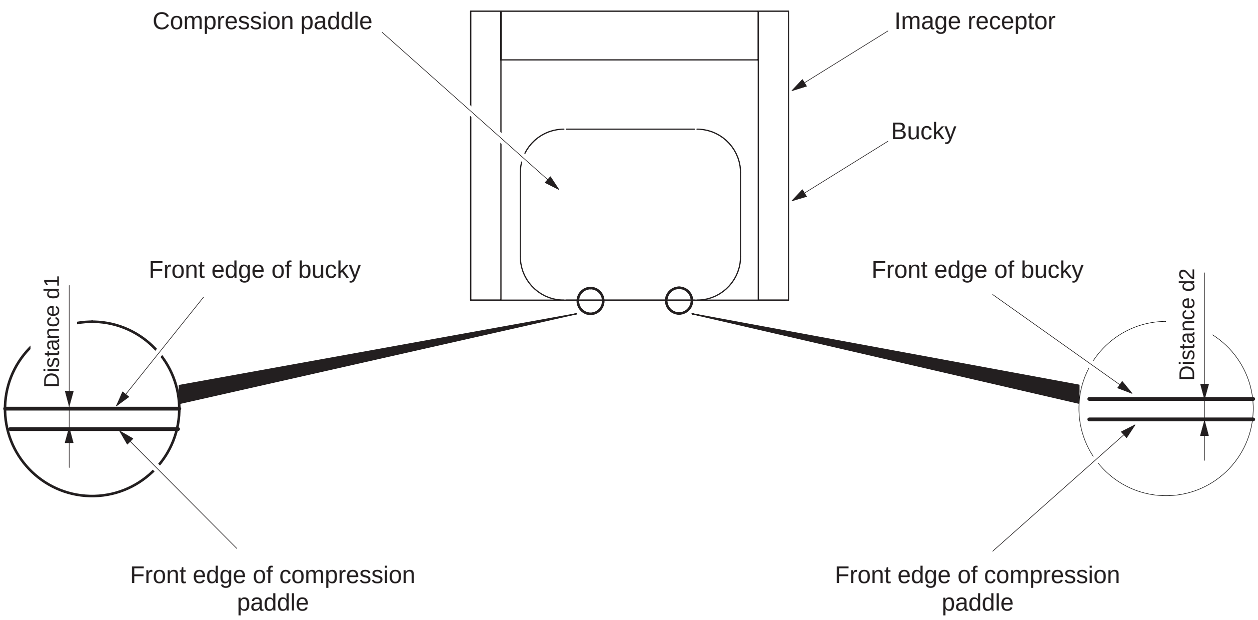
   If the criterion is not met, perform the following points.

4. Remove tube housing spacer covers. See DR 011, Chapitre 4.
5. Remove the front and left examination arm covers. See DR 017, Chapitre 4.
6. Loosen the two allen screws and move the bucky connector support.
7. Move the assembly to correct the alignment.
8. Re–tighten the screws.
9. Check the distance d. Once the alignment is satisfactory, proceed to the next check below.

5.2 Check parallelism between front edge of compression paddle and front edge of bucky .

1. Setup the Senographe in the following configuration:
   - Bucky 18X24.
   - Compression paddle 18X24.

ILLUSTRATION 2



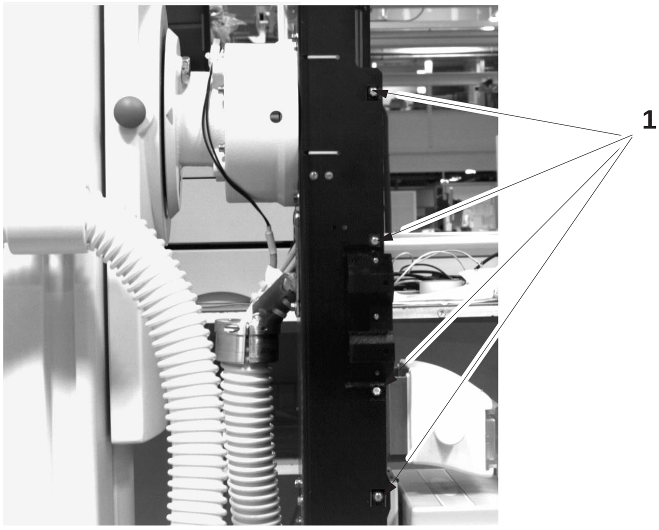
2. Use the ruler to measure carefully distances d1 and d2. See Illustration 2.

   CRITERION: The difference between d1 and d2 must be less than 1mm.

   If the criterion is not met, perform the following points.

3. Perform the points from step 4. to step 5. in Section 5.1, if the examination arm covers are not removed.
4. Loosen the four screws (Ill. 3, rep.1) fixing square guide and rotate the compression paddle holder assembly to correct the parallelism.
5. Re–tighten the four screws.

ILLUSTRATION 3
REPOSITIONING OF THE SQUARE GUIDE



5.3 Check no presence of front edge of magnification stand on the film.

1. Using normal application mode, set up a manual (2–point) exposure as follows:
   - 1.5 Magnification stand installed.
   - No compression paddle.
   - Small focus collimator blade.
   - 25 KV.
   - 4 mAs.

CAUTION

It is critical that the FOCAL SPOT be SMALL.

2. Install the cassette loaded with fresh film.
3. Take an exposure and develop the film.

   CRITERION: The front edge of the magnification stand must not appear on the film.

   If the criterion is not met, readjust the position of the bucky.

5.4 Check no presence of front edge of compression paddle on film

1. Using normal application mode, set up a manual (2–point) exposure as follows:
   - No magnification stand.
   - Compression paddle 18X24.
   - Large focus collimator blade.
   - 25 KV.
   - 16 mAs.
2. Install the cassette loaded with fresh film.
3. Put the compression paddle in contact with the bucky.
4. Take an exposure and develop the film.

   CRITERION: The front edge of the compression paddle must not appear on the film.

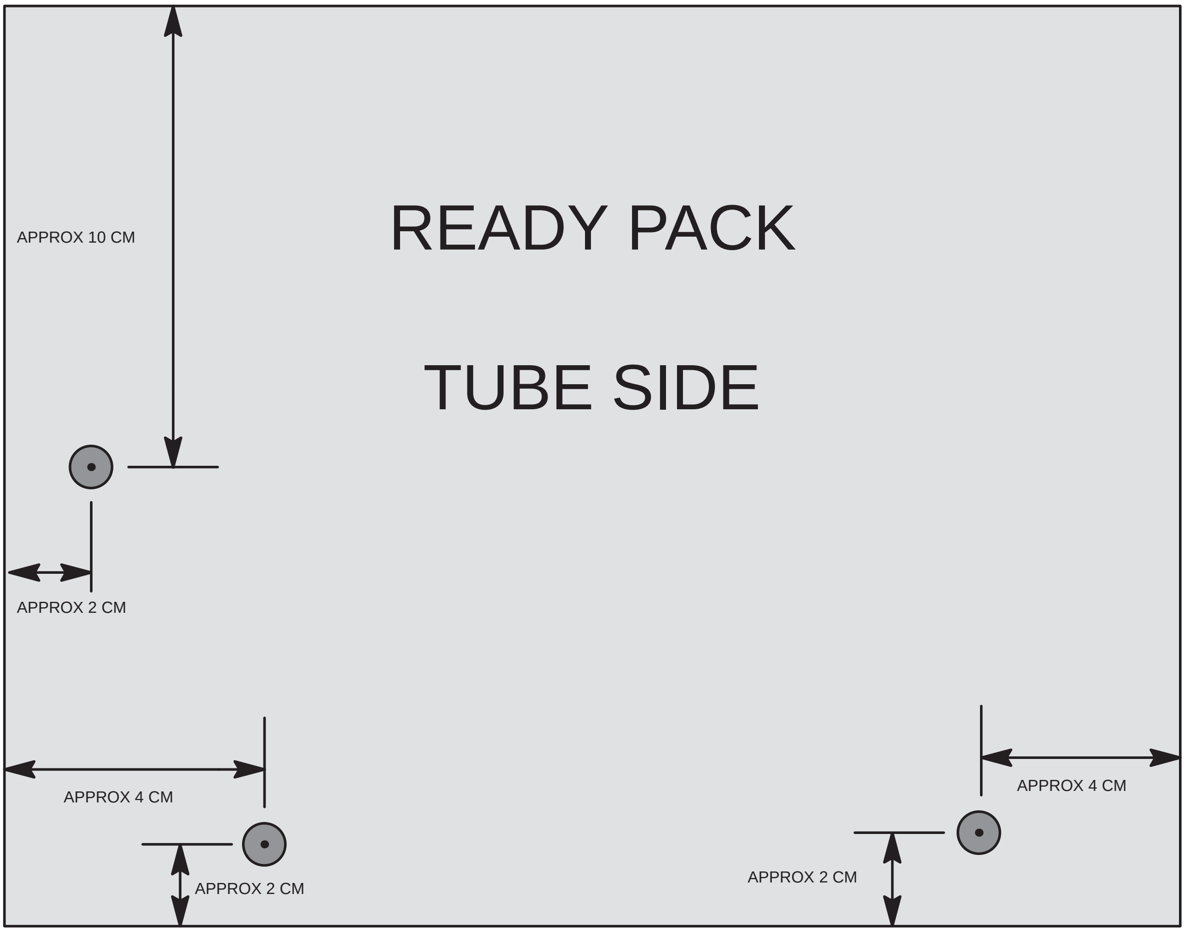
   If the criterion is not met, readjust the position of the bucky.

5.5 Prepare the check of collimator

1. Set up the Senographe in the following configuration:
   - No magnification stand.
   - No compression paddle.
   - Bucky 18X24.
2. Take a new carboard cassette or ready Pack and insert three thumb tacks through it, FROM THE SIDE THAT WILL FACE THE X–RAY, in the following way:
   - Two thumb tacks inserted along the (long) edge of the film that will be at the front edge of the bucky, at approximately 2cm in from this edge and approximately 4 cm inwards from the two shorter edges.
   - The third thumb tack along the (short)edge of the film that will be on the left side of the bucky, approximately 2 cm in from this edge and approximately 10 cm from the rear edge of the film. Refer to Illustration 4.

CHECKING X–RAY FILM FORMAT GEOMETRY Job Card CAL 021

ILLUSTRATION 4
PLACEMENT OF THREE THUMB TACKS TO BE INSERTED IN THE READY PACK

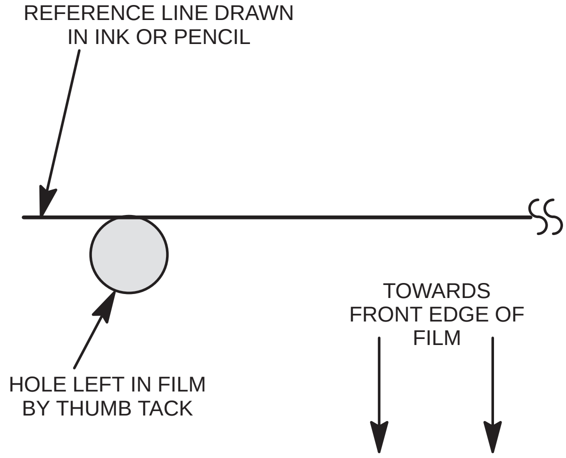


Note: It is NOT important to insert the three thumb tacks in a perfectly (squared(alignment with the edges of the Ready Pack.

3. Place the Ready Pack on the bucky so that the points of the two ”front” thumb tacks butt perfectly up against the front edge of the bucky and the third thumb task butts perfectly up against the left edge of the bucky. THE POSITIONING OF THE THREE THUMB TACKS AGAINST THE BUCKY IS VERY IMPORTANT TO THE SUCCESS OF THESE CHECKS.
4. Using normal application mode, set up a manual (2–point) exposure as follows:
   - Large focus collimator blade.
   - 25 KV.
   - 16 mAs.
5. Take the exposure.
6. Remove the thumb tacks and develop the film.
7. Using the ruler and a pen or pencil, carefully draw a straight line between the rearward edges (i.e. the edges of the holes closer to the front edge of the bucky during the exposure) of the two holes left by the thumb tacks on the front edge of the film. See Illustrations 5 and 6.

   THIS LINE IS THE REFERENCE FOR ALL THE FOLLOWING GEOMETRICAL MEASUREMENTS.
8. Attach the developed film to a sheet of graph paper (or other support marked with a series of perpendicular lines), carefully aligning the front edge reference line with a convenient line on the graph paper. See Illustration 6.

ILLUSTRATION 5
DETAIL OF WHERE TO DRAW REFERENCE LINE ON FILM WITH RESPECT TO HOLES LEFT BY THUMB TACKS



CALIBRATION

5.6 Check parallelism front edge of collimator blade and front edge of bucky.

Use the ruler to measure carefully distances y1 and y2. See Illustration 6.

CRITERION: The difference between y1 and y2 must be LESS THAN 1mm.

If the criterion is not met, perform the following points.

1. Perform the points from step 4. to step 5. in Setion 5.1, if the examination arm covers aren't removed
2. Loosen the four screws (mark A) of the collimator assembly. See Illustration 9.
3. Adjust the two screws (mark B) of the collimator assembly, see Illustration 9:
   - Turn one screw and turn the other screw in the **reverse** direction with the same angle.
4. Check by repeating the exposure.
5. Once the perpendicularity is satisfactory, proceed to the next check below (use the LAST film obtained from the most recent check exposure in the following check).

5.7 Check alignment between left edge of collimator blade and left edge of bucky.

Use the ruler to measure carefully distances T1 and T2. See Illustration 7.

CRITERION: (282 – T1)/2 –T2 = ± 1 mm.

If the criterion is not met, perform the following points.

1. Adjust the two screws (mark B) of the collimator assembly, see Illustration 9:
   - Turn both screws in the **same** direction with the same angle.

CAUTION

Before adjusting the collimator, don't forget to loosen the four screws mark A.

2. Check by repeating the exposure.
3. Once the positioning is satisfactory, proceed to the next check below (use the LAST film obtained from the most recent check exposure in the following check).

5.8 Check alignment between front edge of collimator blade and front edge of bucky

Use the ruler to measure carefully distance y. See Illustration 8.

CRITERION: $0 < y < 2mm$.

If the criterion is not met, perform the following points.

1. Adjust the screw (mark C) of the collimator assembly , see Illustration 9:

CAUTION

Before adjusting the collimator, don't forget to loosen the four screws mark A.

2. Check by repeating the exposure.
3. Once the alignment is satisfactory, re–tighten the four screws. See Illustration 9, mark A.

WARNING

FOR AUSTRALIA AND NEW ZEALAND, THE DISTANCE BETWEEN FRONT EDGE OF COLLIMATOR BLADE AND FILM FRONT EDGE MUST, BE ADJUSTED IN ORDER TO HAVE A WHITE STRIP OF 0.1 TO 1 mm THICKNESS ON THE FILM FRONT EDGE USING A FILM EXPOSED IN STANDARD CONDITION (CUSTOMER CASSETTE INSERTED IN A BUCKY).

ILLUSTRATION 6
CHECKING EXPOSED FILM FOR PARALLELISM BETWEEN FRONT EDGE OF COLLIMATOR BLADE AND FRONT EDGE OF BUCKY

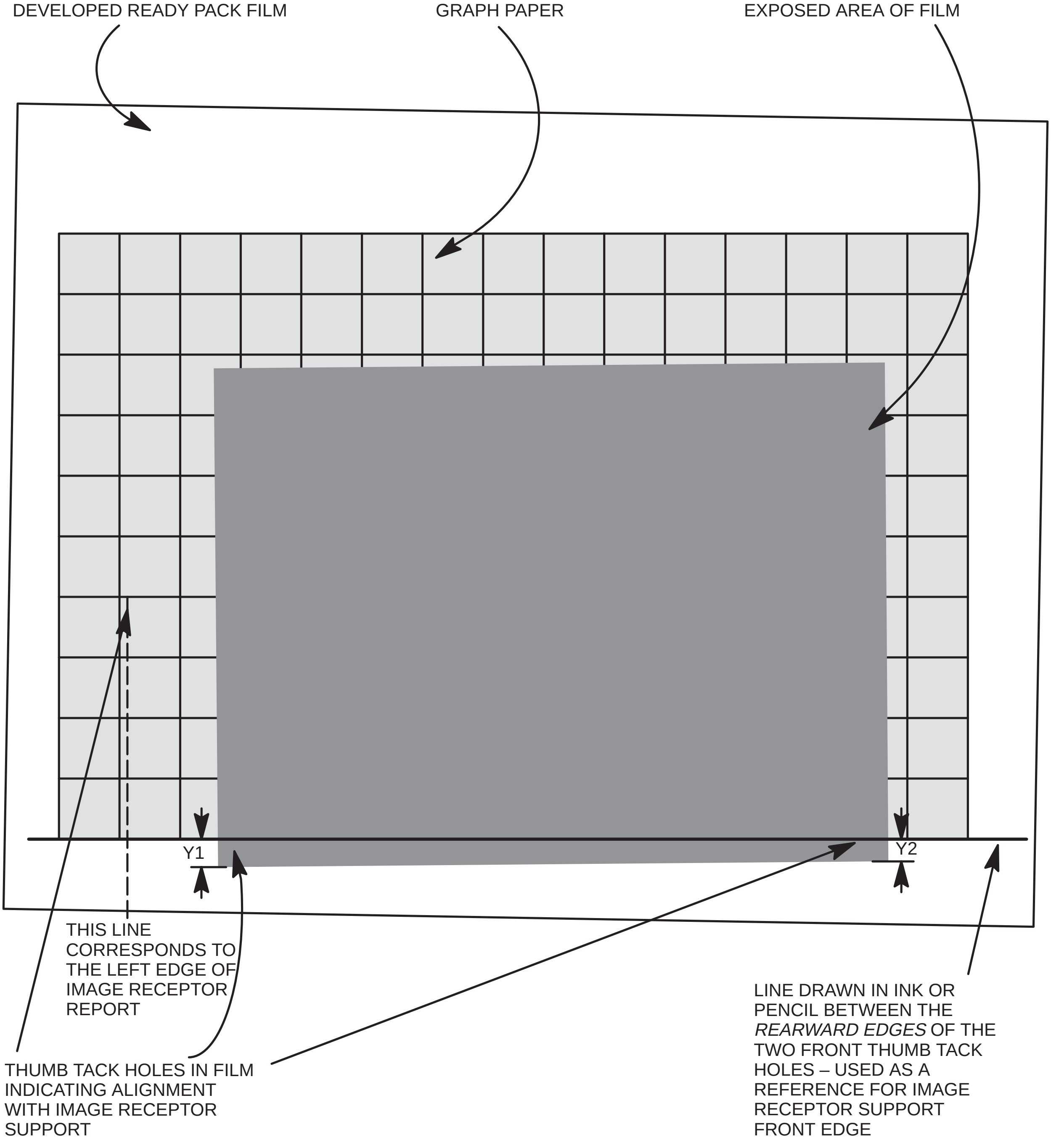
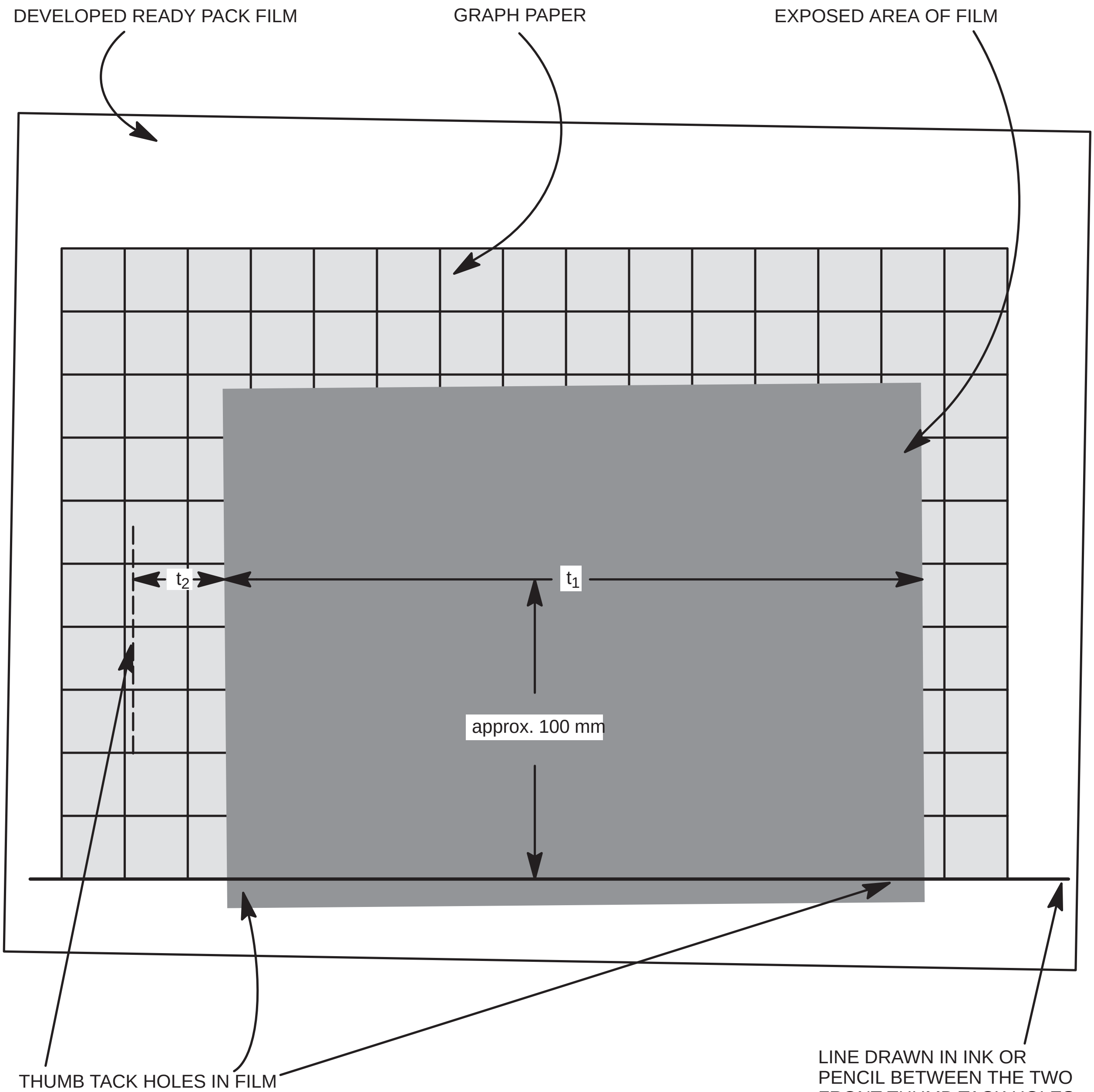


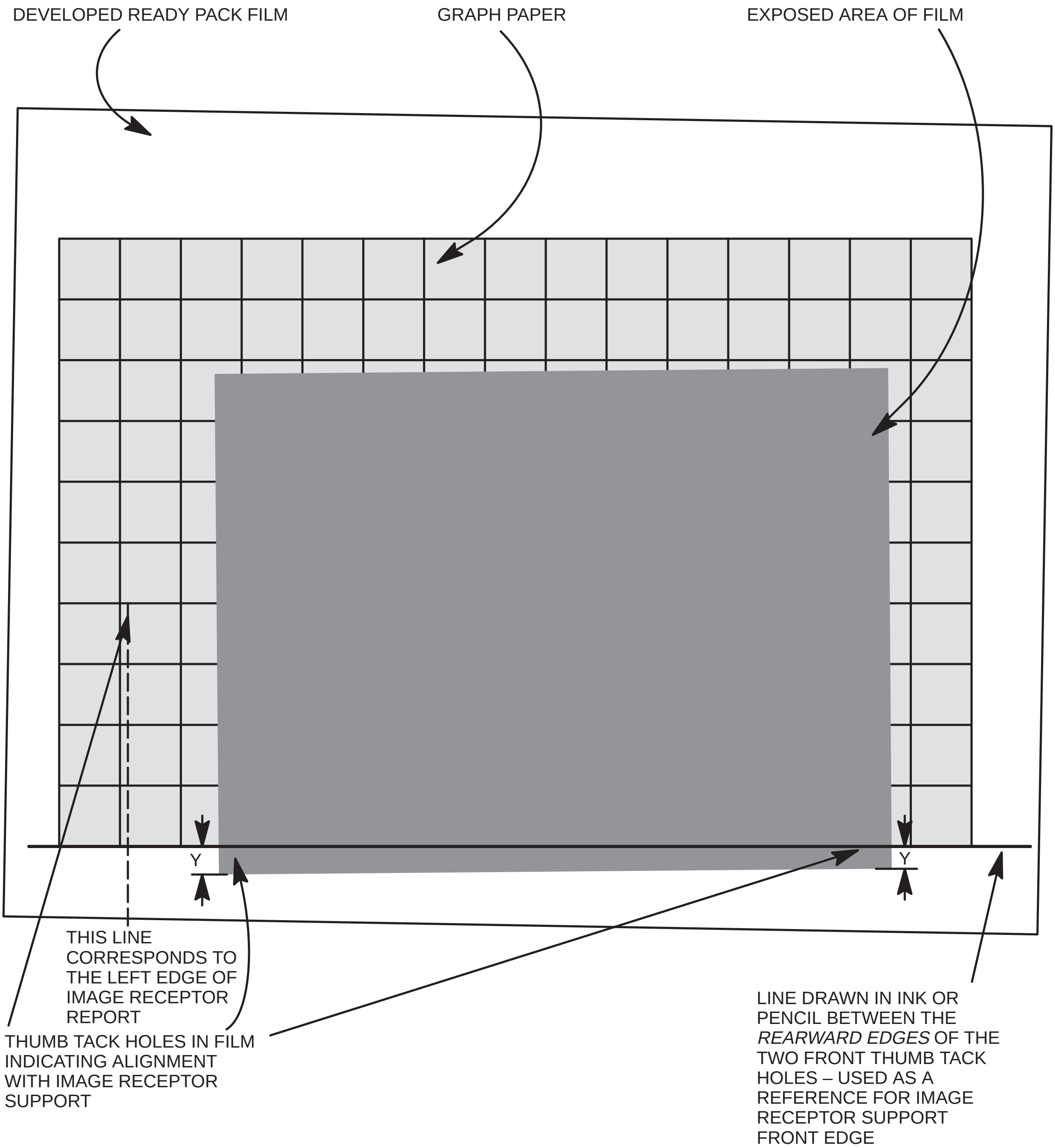
ILLUSTRATION 7
CHECKING EXPOSED FILM FOR ALIGNMENT BETWEEN LEFT EDGE OF COLLIMATOR BLADE AND LEFT EDGE OF BUCKY



CHECKING X–RAY FILM FORMAT GEOMETRY

Job Card CAL 021

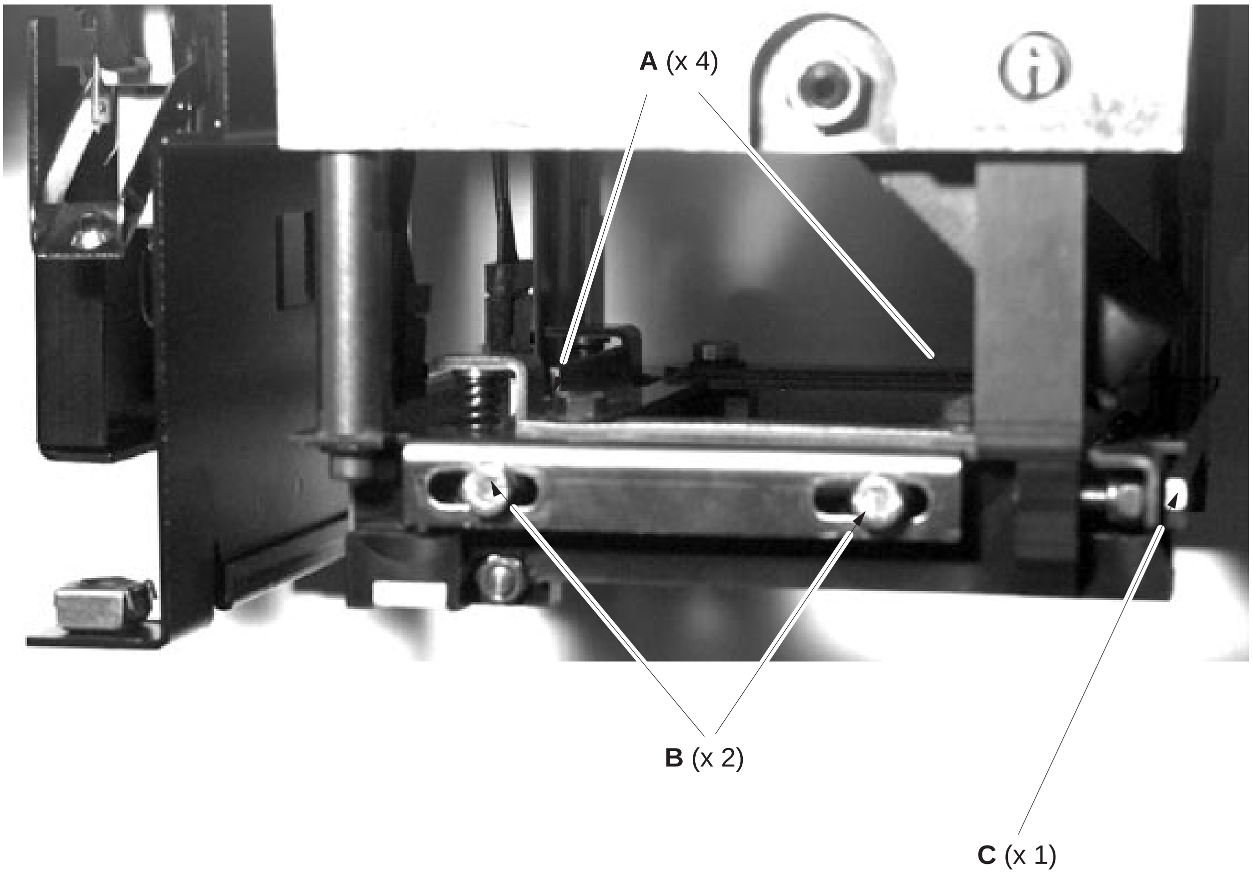
ILLUSTRATION 8
CHECKING EXPOSED FILM FOR ALIGNMENT BETWEEN FRONT EDGE OF COLLIMATOR BLADE AND FRONT EDGE OF BUCKY



CHECKING X–RAY FILM FORMAT GEOMETRY

Job Card CAL 021

ILLUSTRATION 9
COLLIMATOR ASSEMBLY



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Senographe 700T and 800T Job Card CAL 022 1 of 4

Purpose: **MANUAL DETERMINATION OF AOP STRATEGY FOR A GIVEN SCREEN PAIR**	Version No.: A Date: March 15, 2001
Time: x h xx min	Personnel: 1

SECTION 1
SUPPLIES

- Normal cassette of type used in the screen pair being calibrated.
- Film of type used in the screen pair being calibrated.
- Plexiglass in thickness increments of 0.5 cm (minimum plexiglass dimensions 15 x 15 cm to insure complete covering of the photo cell).

SECTION 2
TOOLS

None.

SECTION 3
SAFETY PRECAUTIONS

CAUTION

These procedures produce X–rays. Be sure to take appropriate precautions.

SECTION 4
PREREQUISITES

Generator calibration must be successfully completed for the screen pair in question before this Job Card is performed.

Note: In case of error messages during this calibration, see CAL 023 ”GENERAL ERRORS DURING THE CALIBRATION” for explanations.

Note: This Job Card is not to perform if CAL 013 or CAL 014 have been just perform before: strategy is determited automatically at the end of both Job Cards.

SECTION 5
DETERMINE AOP STRATEGY

This Job Card provides the procedure for determining the AOP strategy parameter for a given screen pair. This is done by taking a reference X–ray exposure in 1–point mode and choosing the AOP strategy parameter according to the resulting mAs from the exposure.

GENERAL INSTRUCTIONS TO BE OBSERVED DURING ALL PROCEDURES GIVEN BELOW IN THIS SECTION:

- Throughout the procedures in this Job Card, the photo cell position must be selected as follows:
  – in **position 1** (towards the patient) for software less or equal to V2.21.
  – in **position 2** for software higher or equal to V2.31.
- When placing plexiglass on the cassette holder, the plexiglass must always overlap the front edge (towards the patient) by about 1 cm to insure that the photo cell is fully covered.

5.1 Set up for and take the exposure.

1. Set up the Senographe in the following configuration:
   - Any compression paddle installed.
   - Contact (no magnification).
   - Grid installed.
   - 4 cm plexiglass on the cassette holder.
   - AEC mode (1–point).
   - HV : 28 kV
   - Filter: **MO**
   - Focus: **LARGE**
2. Load cassette with undeveloped film into cassette holder and take an exposure. Note down the resulting mAs.
3. Determine AOP strategy parameter value according to the resulting mAs value:
   - mAs ≤ 30 => strategy = SUPER FAST
   - 30 < mAs ≤ 50 => strategy = VERY FAST
   - 50 < mAs ≤ 70 => strategy = FAST
   - 70 < mAs ≤ 100 => strategy = MEDIUM
   - 100 < mAs ≤ 150 => strategy = SLOW
   - 150 < mAs => strategy = VERY SLOW

MANUAL DETERMINATION OF AOP STRATEGY FOR A GIVEN SCREEN PAIR Job Card CAL 022

5.2 Enter the AOP strategy parameter value into the Senographe.

1. Starting from application mode, change the position of the installation menu enable switch (switch 8 of B1 on CPU board 300PL4, see ”Accessing the Generator or Gantry Installation Mode from the Console” in Chapter 1).

Note: This must only be done if the Senographe has been switched off since the last access to **SETUP/INSTAL**

2. Starting from application mode, select **SETUP/INSTAL/AOP/ALGO/FSC=*x*/STRAT** on the console, where *x* is the screen pair indicator (A,B,C,D, or E) corresponding to one of the 5 possible screen pairs to be calibrated.
3. Select the AOP strategy as determined above (**VERY SLOW, SLOW, MEDIUM, FAST, VERY FAST** or **SUPER FAST**) on the console.
4. Perform a ”CKSUM” and return to application mode.
5. If you are turning the machine back over to the user at this point, switch the Senographe off, then on again.

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Senographe 700T and 800T — Job Card CAL 023 —

Purpose: **GENERAL ERRORS DURING THE CALIBRATION**	Version No.: A Date: Dec. 18, 1995
Time: x h xx min	Personnel: 1

SECTION 1
SUPPLIES

None.

SECTION 2
TOOLS

None.

SECTION 3
SAFETY PRECAUTIONS

None.

SECTION 4
PREREQUISITES

Note: In case of error messages during this calibration, see CAL 023 ”GENERAL ERRORS DURING THE CALIBRATION” for explanations.

CALIBRATION

SECTION 5
GENERAL ERRORS DURING THE CALIBRATION

700T and 800T	GENERAL ERRORS DURING THE CALIBRATION		
	ERROR MESSAGE	**DESCRIPTION**	**CORRECTIVE ACTION**
RESULT OF CALIBRATION EXPOSURES (WHATEVER JOB CARD IS USED)	**OUT OF ORDER**	Failure	Go back to application mode and note (fix) the error code
	STOP BY ARM	Failure caused by the gantry	Go back to application mode and note (fix) the error code
	TOO HOT	The tube is too hot	Wait for the tube cooling. If it takes more than 20 minutes, then cancel the procedure and do it again.
	ARCING	Too many arcings	Repeat the exposure
	SOFTWARE ERROR	Mistake in calculation of the parameters of a curve by approximation : software error	Inform the Central Support
	NOT ENOUGH PTS	Insufficient number of points acquired. Calibration is not complete or has been interrupted by the operator.	Do the calibration again
	PARAM DISPERSED	Maximum > 1000 time the minimum. Procedure or software error	Do the calibration again. Inform the Central Support.
	ALL PARAM NIL	The matrix determinant = 0. Procedure or software error.	Do the calibration again. Inform the Central Support.
RESULT OF CALIBRATION EXPOSURES (WHATEVER JOB CARD IS USED)	**PIVOT NIL**	The matrix diagonal = 0 but the result is < > 0	Do the calibration again. Inform the Central Support.
	CALIB ERROR	Failure during calibration	Go back to application mode and note (FIX) the error code

GENERAL ERRORS DURING THE CALIBRATION Job Card CAL 023 3 of 8

700 and 800T	**GENERAL ERRORS DURING THE CALIBRATION**		
	ERROR MESSAGE	**DESCRIPTION**	**CORRECTIVE ACTION**
CALCULATION ERROR	**OVERFLOW**	Real number is transformed into a string. Values are out of the interval +/– 9999000000	Check that the AEC calibration has been property done. If yes, then check the cell.
	ERROR 068/022	Floating point calculation error. This error originates generally from invalid parameters calculated during pm yeld calibration (CAL 007). The error can occur whithin CAL 007, 013 or 014	The best way is to restart AEC calibration at level CAL 007, with the right default parameters. Suppose you are calibrating FSC A and that couples B, C, D were not already used ; using procedure CAL 007 Section 6.4 step 1., copy successively from C (no screen) to A (no screen) and C (with screen) to A (with screen).
CONFIGURATION OF THE X–RAY TUBE	**TUBE MISMATCH**	The configuration selected does not exist	Call Engineering.
CAL 003	**Limited ICH**	Some heater current determinated are >5.5 A	Try again. If the problem persists, check CAL 001, 002, 016, 017

GENERAL ERRORS DURING THE CALIBRATION Job Card CAL 023 4 of 8

700T and 800T	ERRORS ASSOCIATED TO A JOB CARD		
	ERROR MESSAGE	**DESCRIPTION**	**CORRECTIVE ACTION**
CAL 005 PHOTOCELL CALIBRATION	**TOO MUCH PLEXI**	PM current is insufficient	Check the thickness of the plexi and check that the bucky is without cassette. Reduce the thickness of the plexi according to the Job Card and do the calibration again. This problem may come from the hardware —> check the photocell board 200–PL5. Change photocell if necessary.
	NOT ENOUGH PLEXI	PM current is too high	Check the thickness of the plexi. Increase the thickness of the plexi according to the Job Card and do the calibration again. This problem may come from the hardware —> check the photocell board 200–PL5. Change photocell if necessary.
	OUT OF ORDER	Failure	Go back to application mode and note (FIX) the erro code.This message is often linked with error 037/003; invalid PM offset. Perform AEC Photocell checks for HVPM and PM offsets (see Job Card)
	ARM ABSENT	Default generator configuration	Select ”arm present” in the CONFIG menu of the generator

CALIBRATION

GENERAL ERRORS DURING THE CALIBRATION

Job Card CAL 023

700T and 800T	ERRORS ASSOCIATED TO A JOB CARD		
	ERROR MESSAGE	**DESCRIPTION**	**CORRECTIVE ACTION**
CAL 007 PM YELD	**GRID ABSENT**	Test of the presence of the grid	Put bucky
	GRID PRESENT	Test of the presence of the grid	Take out the bucky
	RH FILTER OFF (Version 800T)	Control of the tube and RH filter version	Check the tube configuration
	HV = MIN, KV CHGE HV = MAX, CFG CHGE REDUCE HV AGAIN RISE HV AGAIN, ARCING	Information messages : only appear when the operator interrupts the calibration	Wait 2 mm. Press the exposure button to continue the calibration
	PM yield incorect	Calculation error	Copy parameters ”x” to another unused couple ”y”. Continue calibration with couple ”y”. Couple ”x” can be used with another screen calibration.
CAL 008	**Error**	Frequency for angle or face is out of tolerance	Go back to application menu and note (Rx) the error. If no error, try calibration again.
	1 measure less	A measure is missing	Go back to calibration menu, and excute the measure missing
CAL 009	**1 measure less**	A measure of potentiometer calibration is missing	Go back to calibration menu, and perform POTENT calibration

GENERAL ERRORS DURING THE CALIBRATION

Job Card CAL 023

700T and 800T	ERRORS ASSOCIATED TO A JOB CARD		
	ERROR MESSAGE	**DESCRIPTION**	**CORRECTIVE ACTION**
CAL 013 NON RECIPROCITY CALIBRATION	**ANOTHER FILM**	The delta of the measured optical density exceeds the acceptable range : —> make another exposure to continue the calibration	Reload the cassette and continue the calibration
	ODMEA TOO SMALL **ODMEA TOO LARGE**	The measured optical density is out of the acceptable limits	Check the value entered
	INVALID PARAM	The curve determined by coefficient A0, A1, A2, is not valid	Check the root values of parameters A0, A1, A2, (see Job Card)
	CALCUL. ERROR	Calculation error of the non–reciprocity coefficients	Redo the calibration with the root parameters (A0, A1, A2) indicated in the Job Card
	CHECK PLEXI CM	If the measured thickness is too much different from the plexi thickness required (+/– 0.5 cm)	Check the thichness of the plexi. Check CAL 007
	Error calcul	Calculation error	Call engineering Redo CAL 013
	Bad fit correlation	The curve determined by coeff A0, A1, A2 is not valid	Redo CAL 013
	Param out of tolerance	A0, A1, A2 out of tolerance A1 $\leq$ 0 or A2 $\leq$ 0 A1 > 0,5 or A1 $\leq$ 0	Redo CAL 013
	No config	It is impossible to find a configuration (kV, thick) to reach the exposure time desired.	Check CAL 005 Check CAL 006 Check CAL 007 Call engineering

GENERAL ERRORS DURING THE CALIBRATION

Job Card CAL 023

700T and 800T	ERRORS ASSOCIATED TO A JOB CARD		
	ERROR MESSAGE	**DESCRIPTION**	**CORRECTIVE ACTION**
CAL 014 REFERENCE ENERGY CALIBRATION	**OD_MS = TOO LOW OD_MS = TOO HIGH**	The mAs used for the exposure are too low or too hight. This may also be an error in the measurement of the optical density.	Change the mAs value or enter the right value of the optical density
	ARCING STOP	Too many arcings : calibration stopped	No specific action : try to make the exposure again
CAL 015 MAGNIFICATION CORRECTION	**REDUCING HT RISING HT**	Information message : if the exposure button has been relased during the calibration	Press the exposure button to continue the calibration
CAL 016 mA CALIBRATION	**OUT OF RANGE**	The entered mA value is out of acceptable range. (40 mA mini – 60 mA maxi)	Do the calibration again or check the Hardware
CAL 017 KV CALIBRATION	**OUT OF RANGE**	The entered tension value exceed normal value by more than 15%. The calculated parameters deviate from normal value by more than 15%	Do the calibration again or check the Hardware
CAL 20 TUBE WARM–UP	**TOO MANY SPITS**	If more than 5 arcings at 22 KV. If the number of returns from 26 KV to 22 KV is > or = 3. If the number of exposures for the same KV value is > or = 10	Change the tube

GENERAL ERRORS DURING THE CALIBRATION

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Senographe 700T and 800T — Job Card CAL 024

Purpose: **+5V LVPS ADJUSTMENT**	Version No.: A Date: Dec. 18, 1995
Time: x h xx min	Personnel:

SECTION 1
SUPLLIES

None.

SECTION 2
TOOLS

Accurate digital voltmeter (fluke 87 or equivalent).

SECTION 3
SAFETY PRECAUTIONS

None.

SECTION 4
PREREQUISITES

Note: In case of error messages during this calibration, see CAL 023 ”GENERAL ERRORS DURING THE CALIBRATION” for explanations.

+5V LVPS ADJUSTMENT

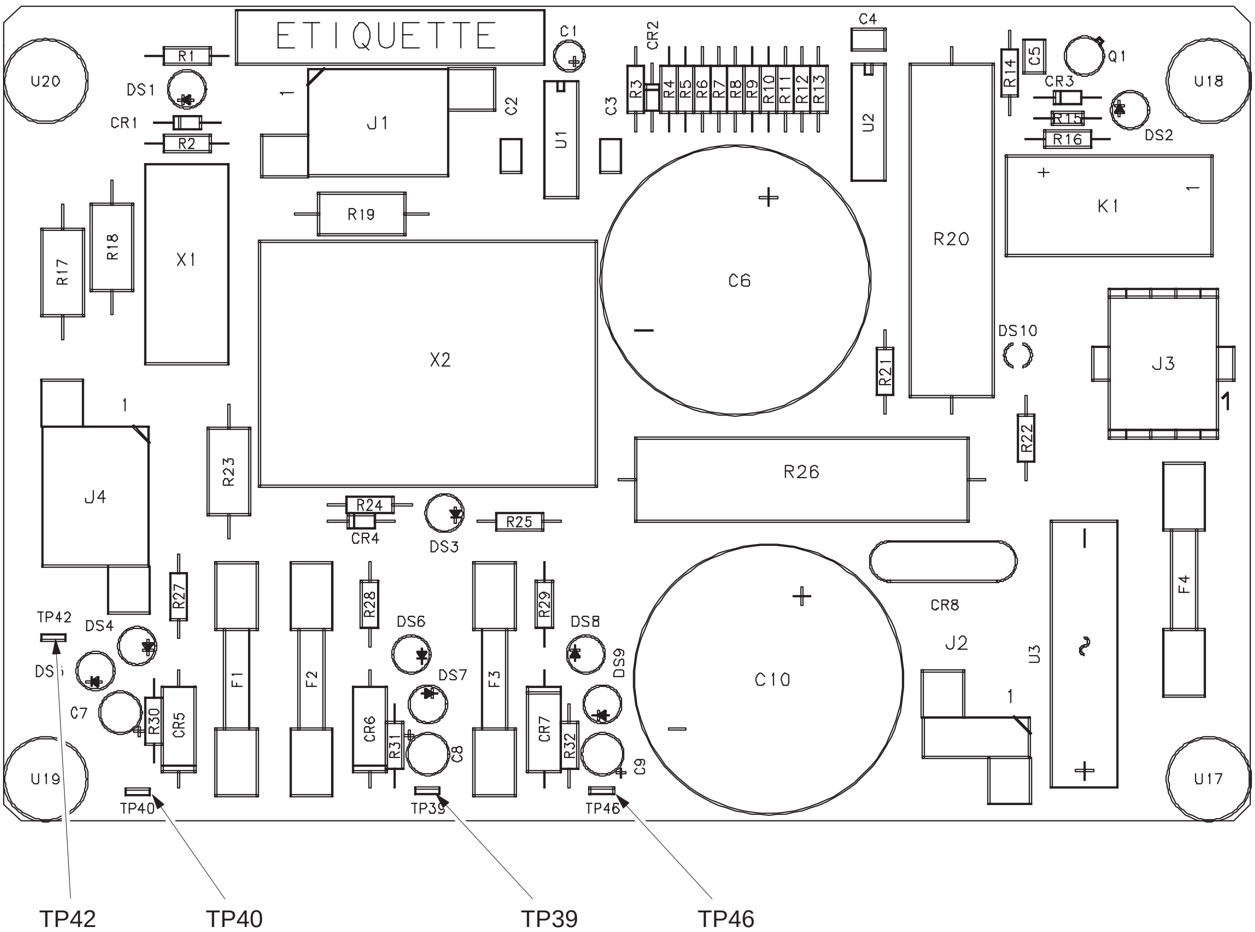
SECTION 5
+5V LVPS MEASURE, ADJUSTMENT AND CHECK

The objective is to measure the +5V voltage of Low Voltage Power Supply, to adjust it if it is not in the right range, and check ± 15V LVPS depending on the +5V LVPS.

5.1 +5V LVPS MEASURE

1. Open Mains Supply Disconnector 300 S1.
2. Disconnect J1 from 300PL17 Low Voltage Distribution Board.
3. Close Mains Supply Disconnector 300 S1.
4. On 300PL17, measure DC voltage (+5VS) between TP39 and TP42 (GND). The voltage should be in the range +5.2 to +5.25 VDC (See Illustration 1).

ILLUSTRATION 1
LOCATION OF TEST POINTS PT39, PT40, PT42, AND PT46 FOR CHECKING KEEP–ALIVE SUPPLY VOLTAGE ON DISTRIBUTION BOARD 300PL17



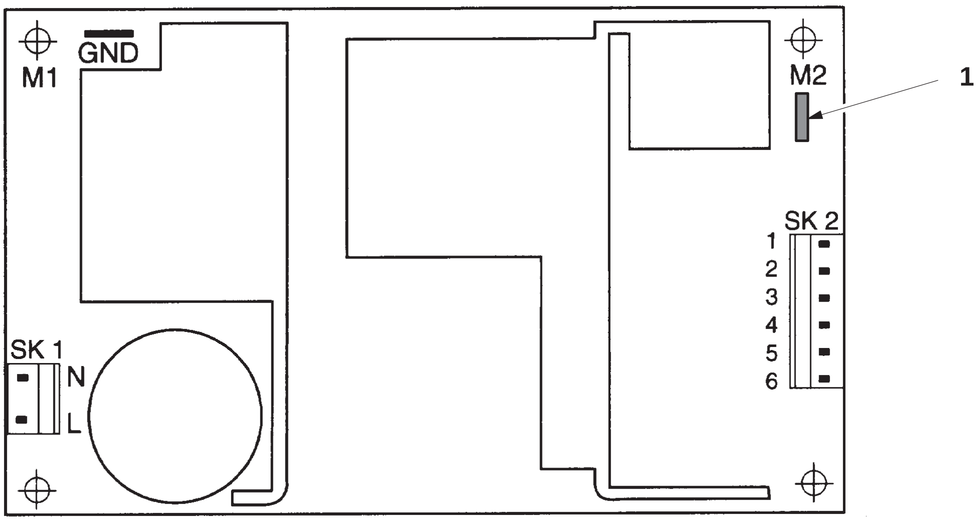
+5V LVPS ADJUSTMENT

Job Card CAL 024

5.2 +5V LVPS adjustment

1. Adjust the potentiometer on LVPS if the voltage is outside the range of the point 4. See Illustration 2, item 1.

ILLUSTRATION 2
POTENTIOMETER LOCATION IN LVPS



5.3 +5V LVPS checking in charge (Switch ON)

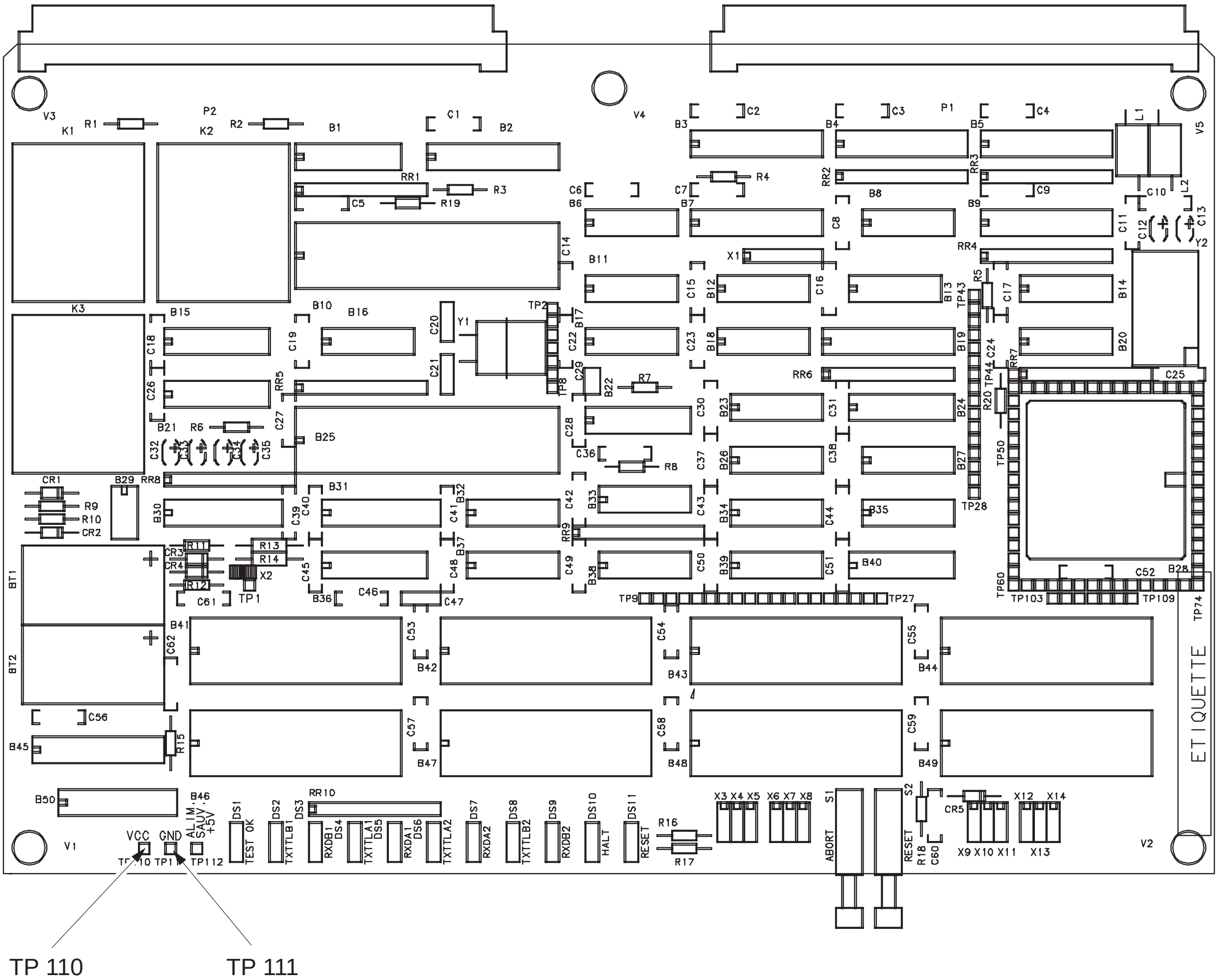
1. Open Mains Supply Disconnector 300 S1.
2. Reconnect J1 to 300PL17, measure DC voltage Distribution Board.
3. Close Mains Supply Disconnector 300 S1.
4. Switch ON.
5. On 300PL17, measure DC voltage (+5VS) between TP39 and TP42 (GND). The voltage should be in the range +5.1 to +5.15 VDC (See Illustration 1).

+5V LVPS ADJUSTMENT

5.4 +5V LVPS checking in charge (Switch ON)

1. Swich ON on the console.
2. On 300PL17, measure DC voltage (+5VS) between TP39 and TP42 (GND). The voltage should be in the range +5.1 to +5.15 VDC (See Illustration 1).
3. On 300PL17, measure DC voltage (+15VS) between TP40 and TP42 (GND). The voltage should be in the range +15 to +16 VDC (See Illustration 1).
4. On 300PL17, measure DC voltage (–15VS) between TP46 and TP42 (GND). The voltage should be in the range –14.25 to –15.75 VDC (See Illustration 1).
5. On 300PL4 CPU Board, measure DC voltage (+VCC) between TP110 and TP111 (GND). The voltage should be in the range +4.9 to +5.15 VDC (See Illustration 3).

ILLUSTRATION 3
300PL4 CPU BOARD 210204

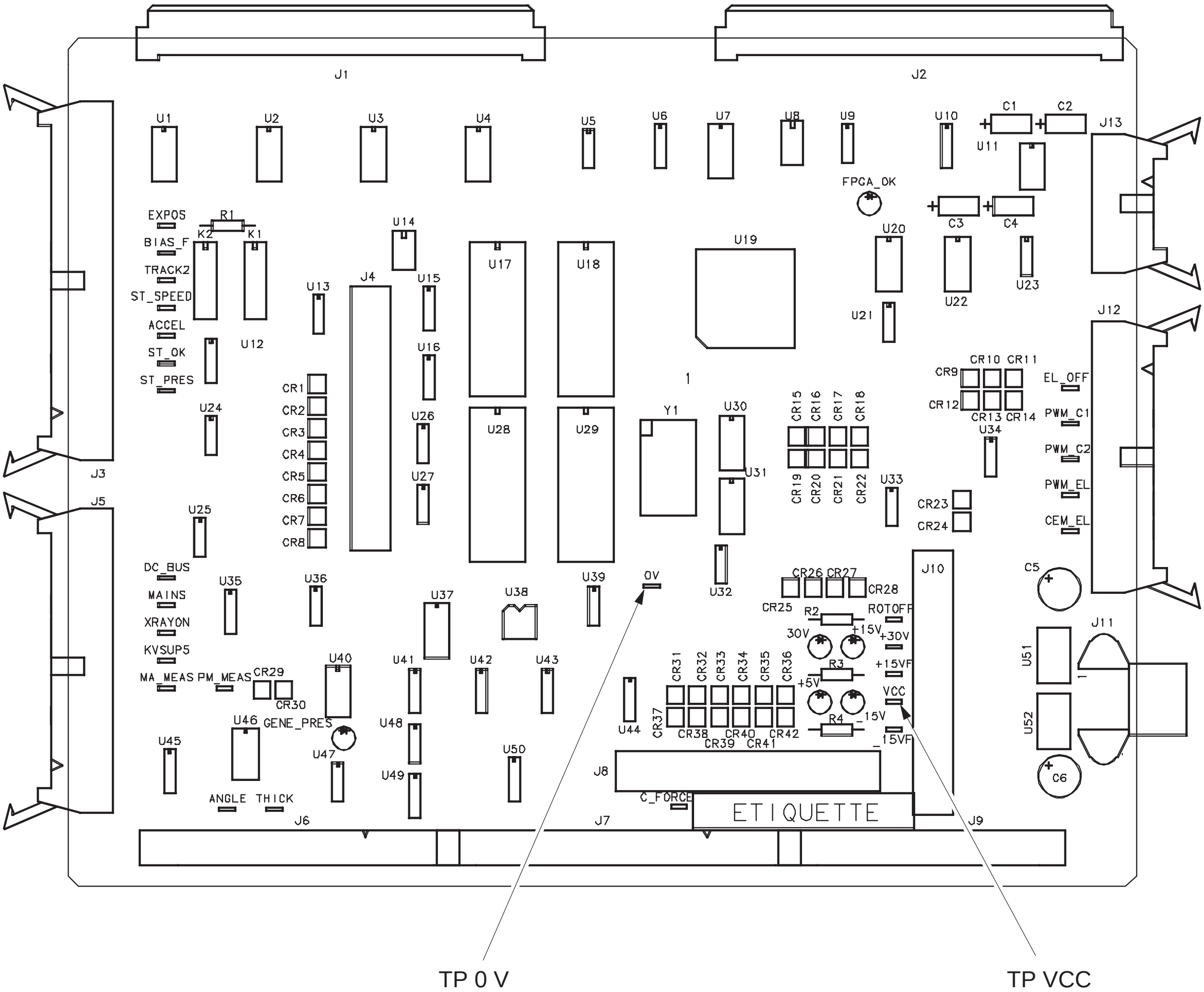


+5V LVPS ADJUSTMENT

Job Card CAL 024 5 of 6

6. On 300PL5 Generator and Arm Interface Board, measure DC voltage between TP VCC and TP 0 V. The voltage should be in the range +4.9 to +5.15 VDC (See Illustration 4).

ILLUSTRATION 4
300PL5 INTERFACE BOARD 211841



+5V LVPS ADJUSTMENT

Job Card CAL 024

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Senographe 700T and 800T — Job Card CAL 025

Purpose: **CHECK & ADJUSTMENT OF CENTERING DEVICE LAMP**	Version No.: A Date: Dec. 18, 1995
Time: 1 h 00 min	Personnel: 1

SECTION 1
SUPPLIES

None

SECTION 2
TOOLS

- Standard Field Engineer toolkit.
- Ruler calibrated in mm.
- Paper clips.
- Sheet of paper (about 267 mm x 195 mm to cover a 18x24 cassette).

SECTION 3
SAFETY PRECAUTIONS

CAUTION

This procedure produces x–rays. Be sure to take appropriate precautions.

SECTION 4
PREREQUISITES

- X–ray film format geometry must be adjusted correctly (see Job Card CAL 021).
- Job Card DR 011 (Removing and Reinstalling Tube Housing Spacer Covers).

SECTION 5
CHECK AND ADJUSTMENT OF CENTERING DEVICE LAMP

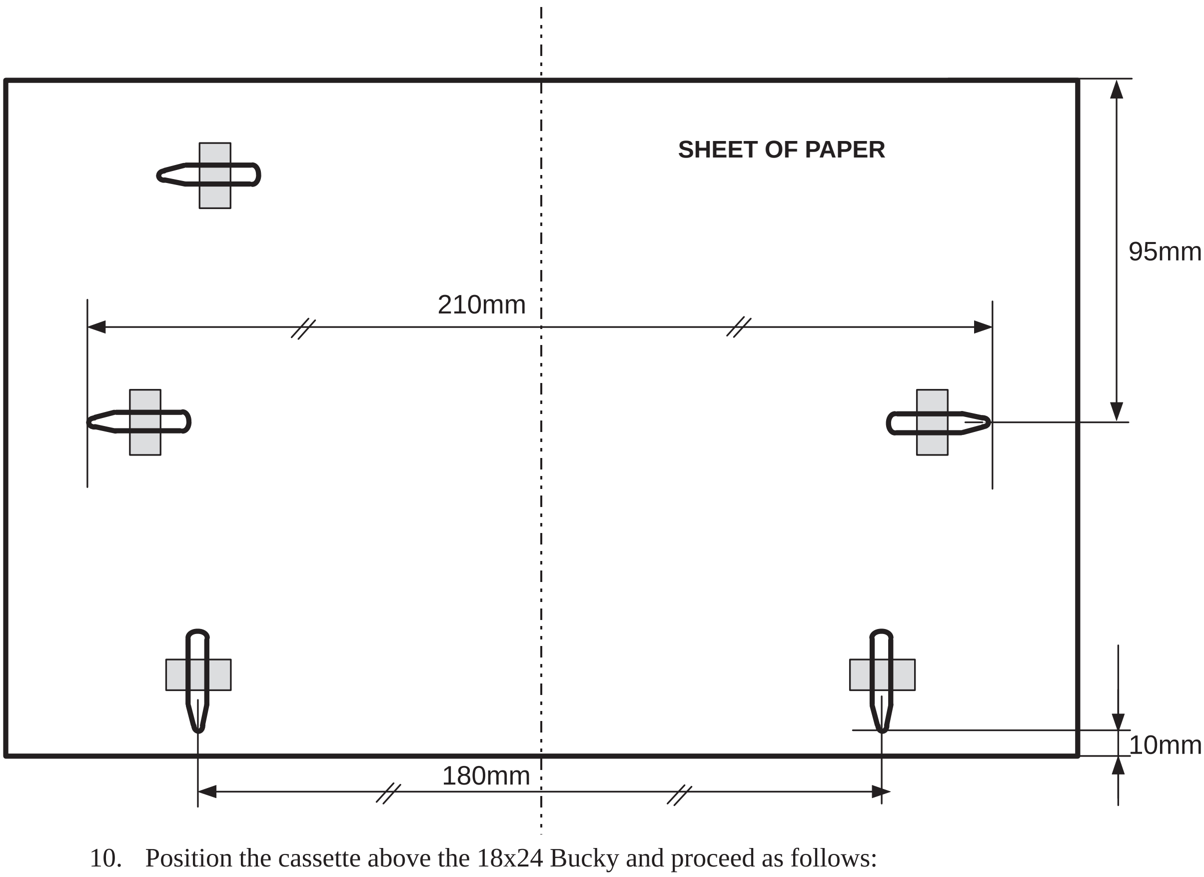
The purpose is to check and adjust (if necessary) the position of the centering device lamp in two dimensions, so that the lighted field coincides, within acceptable tolerances, with the exposed x–ray field. This is done by first exposing a film and then illuminating it on the 18x24 Bucky to check the coincidence of the lighted field with the exposed area on the x–ray film. The properties of this coincidence are measured and adjusted, if necessary, in the following order:

- Lateral centering,
- Front–edge coincidence.

5.1 Prepare the Senographe for Exposure

7. Set up the Senographe in the following configuration:
   - No magnification stand.
   - No compression paddle.
   - 18x24 Bucky.
8. Prepare a sheet of paper of the size of the 18x24 cassette (about 267 mm x 195 mm).
9. Affix paper clips to the sheet of paper using adhesive tape, as shown in Illustration 5.

ILLUSTRATION 5
SHEET USED FOR PREPARATION



10. Position the cassette above the 18x24 Bucky and proceed as follows:
    a. Center in the lateral plane and mark the position on one side with a piece of adhesive tape to allow subsequent repositioning of the cassette in the same position.
    b. Position in contact with the rear edge of the cover, so that the front edge of the cassette is 3 mm beyond the front edge of the Bucky.

11. Place the prepared sheet of paper on the cassette and center.

5.2 Perform Exposure

1. Using normal Application Mode, set up a manual (2 points) exposure as follows:
   – Large focal collimator blade 18x24 LF.
   – 25 kV.
   – 16 mAs.
2. Perform exposure.
3. Save the prepared sheet of paper and develop the film.

5.3 Check and Adjust (if necessary) Lateral Centering

Note: It is recommended to switch off all room lighting before proceeding with the following steps.

CAUTION **When tube housing covers are removed, protect eyes from light using a sheet of paper affixed around the centering light.**

1. Re–affix the prepared sheet of paper on the cassette using adhesive tape.
2. Reposition the cassette in the same position above the Bucky.
3. Place the developed film on the prepared sheet of paper, with the same orientation as during the exposure, and align it using the paper clips. When adjusted, affix to the sheet of paper using adhesive tape.
4. Study the relationship between the illuminated zone from the light centering device and the darkened area on the film.
5. Determine if the two areas are laterally centered (Illustration 6 shows correct lateral centering).

CAUTION **Before adjusting the light centering device, loosen the two screws shown in Illustration 8 (Callout A).**

6. If the two areas are not laterally centered, turn Adjustment Screw B (see Ill. 7) until the illuminated area is laterally centered with the darkened area on the film.
7. When the alignment is satisfactory, re–tighten the two screws (Ill. 8, Callout A).

ILLUSTRATION 6
CORRECT LATERAL ALIGNEMENT OF AREA ILLUMINATED BY LIGHT CENTERING DEVICE WITH EXPOSED AREA OF X–RAY FILM

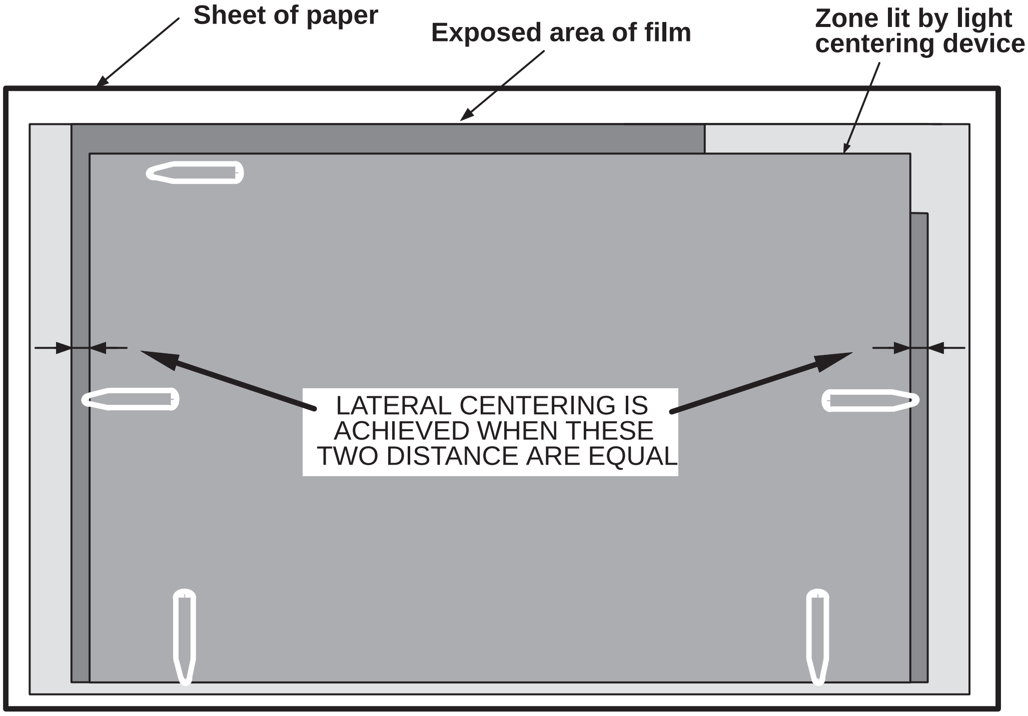
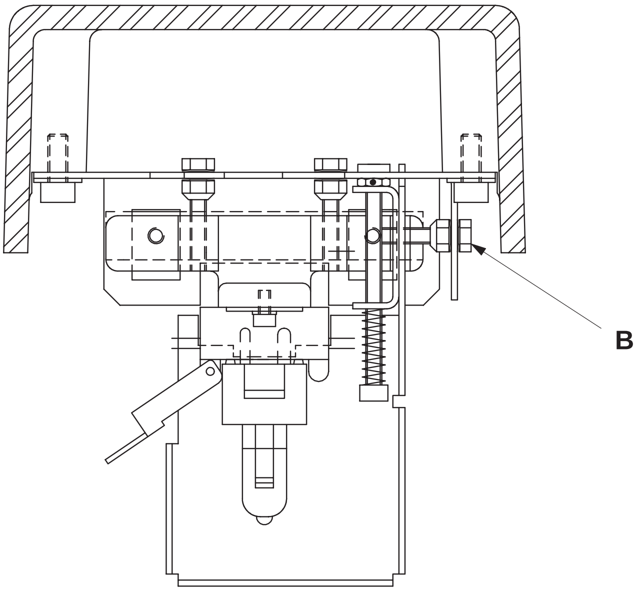


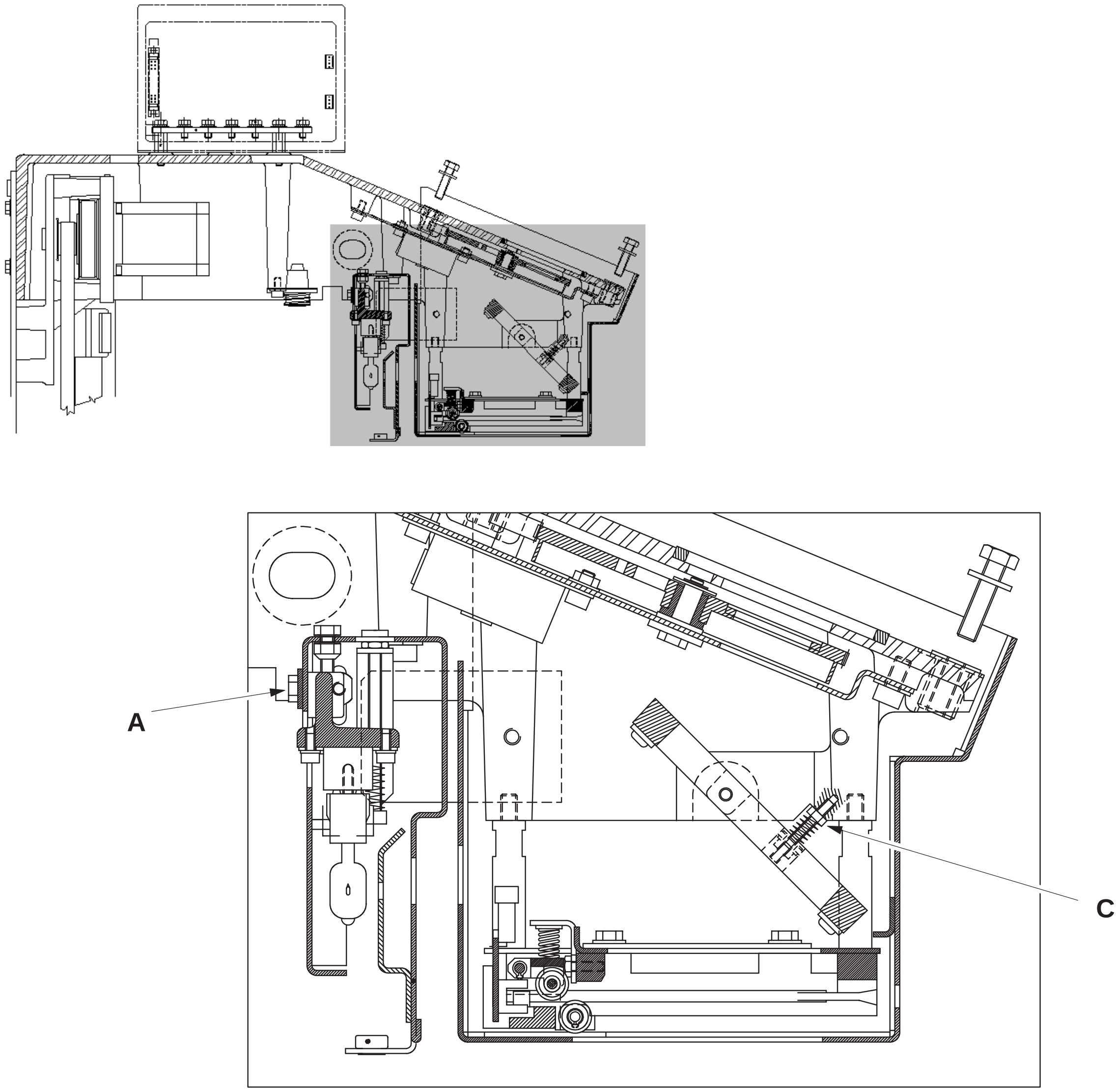
ILLUSTRATION 7
LIGHT CENTERING DEVICE ASSEMBLY (SCREW B)



CHECK & ADJUSTMENT OF CENTERING DEVICE LAMP

Job Card CAL 025

ILLUSTRATION 8
LIGHT CENTERING DEVICE ASSEMBLY (Screws A and C)

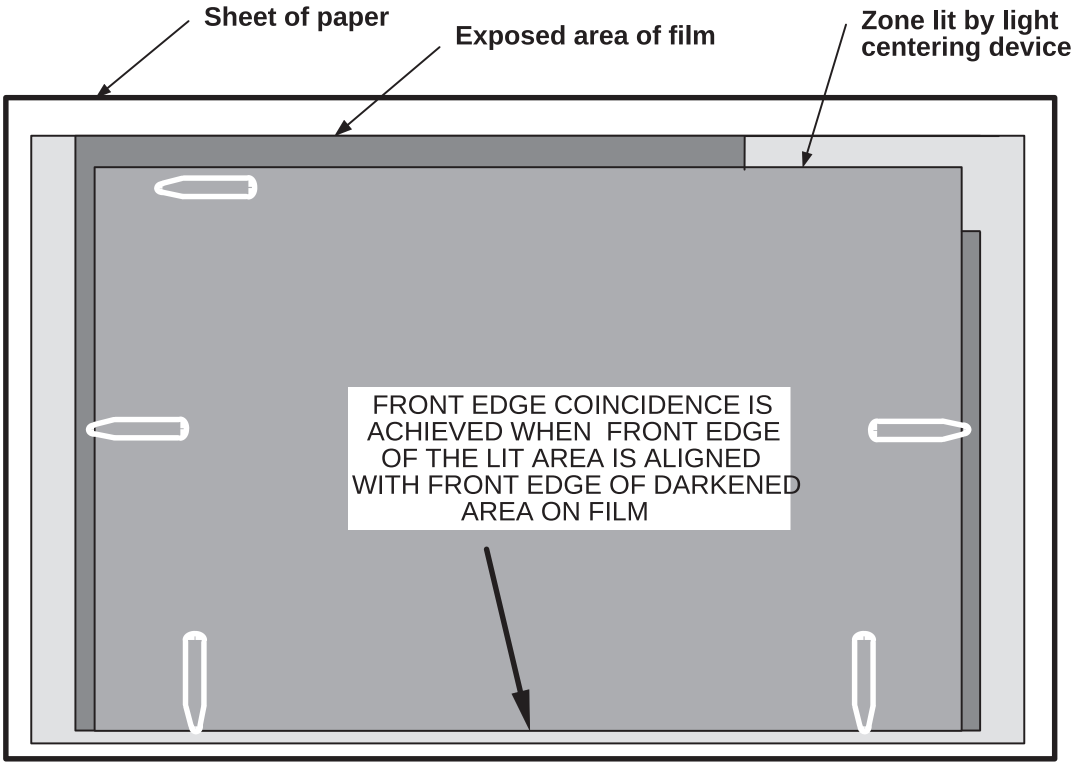


CHECK & ADJUSTMENT OF CENTERING DEVICE LAMP — Job Card CAL 025

5.4 Check and Adjust (if necessary) Front–Edge Coincidence

1. Maintain the cassette aligned on the Bucky with the sheet of paper and developed film as above.
2. Study the relationship between the illuminated area from the light centering device and the darkened area on the film.
3. Determine if the the two front edges are aligned (Illustration 9 shows correct front–edge coincidence).

ILLUSTRATION 9
FRONT–EDGE COINCIDENCE BETWEEN AREA ILLUMINATED BY LIGHT CENTERING DEVICE AND EXPOSED AREA OF X–RAY FILM



4. If the two front edges are not aligned, proceed as follows:
   a. Move the collimator blade back.
   b. Remove the x–ray protective box by unscrewing the four screws.
   c. Move the collimator blade forward.
   d. Adjust the mirror by turning Screw C (see Ill. 8) until the illuminated area front edge is aligned with the darkened area front edge on the film.
   e. Reinstall the x–ray protective box.
   f. Reinstall the tube housing covers (see Job Card DR 011).

Senographe 700T and 800T Job Card CAL 026

Purpose: **CHECK & ADJUSTMENT OF ELEVATOR SAFETY SWITCH**	Version No.: A Date: Dec. 18, 1995
Time: 30 min	Personnel: 1

SECTION 1
SUPPLIES

None

SECTION 2
TOOLS

- Standard Field Engineer toolkit.
- A dynamometer (or spring scale) capable of measuring forces between 1 and 5 daN (2.2 and 11 pounds).

SECTION 3
SAFETY PRECAUTIONS

None

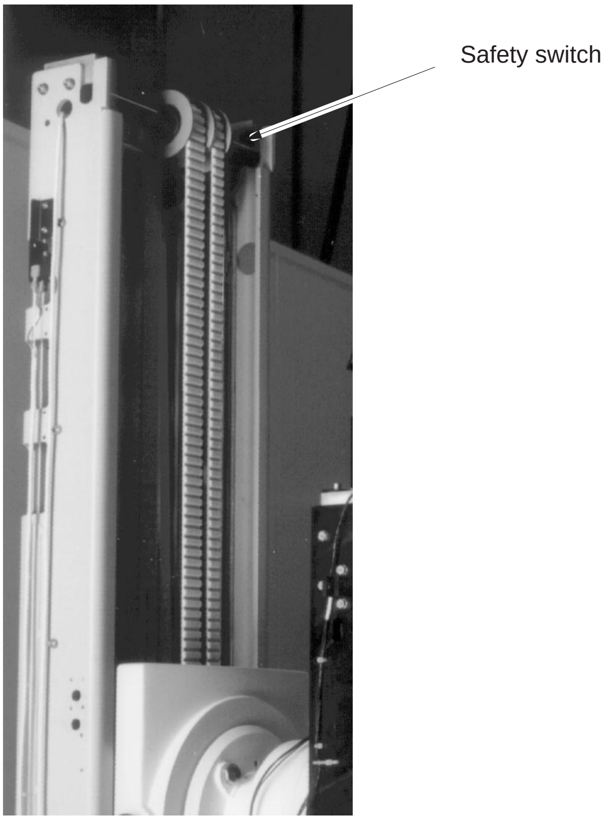
SECTION 4
PREREQUISITES

- Job Card DR005, “Removing and Re-installing the Front Covers of the Column.”

SECTION 5
CHECK AND ADJUSTMENT OF ELEVATOR SAFETY SWITCH

The purpose is to test and adjust (if necessary) the triggering of the elevator Safety Switch 200S5 (see Ill. 1). When a break in one of the two belts occurs, this switch must be activated.

ILLUSTRATION 10
LOCATION OF SAFETY SWITCH



CHECK & ADJUSTMENT OF ELEVATOR SAFETY SWITCH Job Card CAL 026

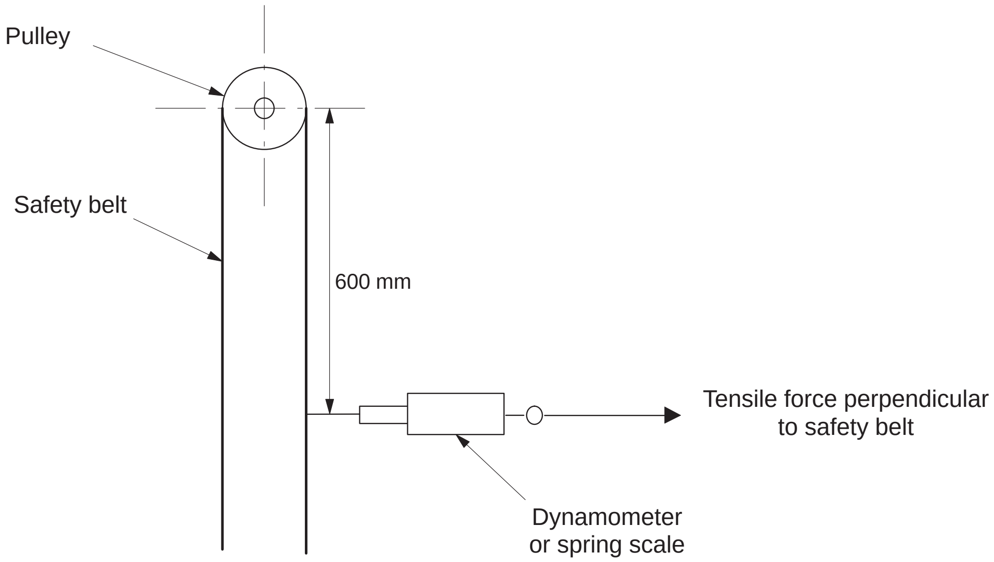
5.1 Test of Safety Switch Trigger

1. Check that the safety microswitch for the belt is not triggered over the full travel of the examination arm carriage.
2. Position the carriage in the low end-of-travel position. Apply tension perpendicular to the safety belt using the dynamometer, placed 600 mm from the axle for both pulleys. The safety microswitch should be triggered at a force of between 3.5 daN ± 5% (7.7 ± 5% pounds).

Note: When the safety switch is triggered, Error Code E72 (COLUMN FAILURE 156/026) is displayed on the Console. To cancel this error, reset the Senographe by switching the unit OFF then ON.

3. Carry out a full top-to-bottom movement of the carriage and repeat the measurement described in Step 2 with the carriage in the low end-of-travel position.

ILLUSTRATION 11
DYNAMOMETER POSITIONING

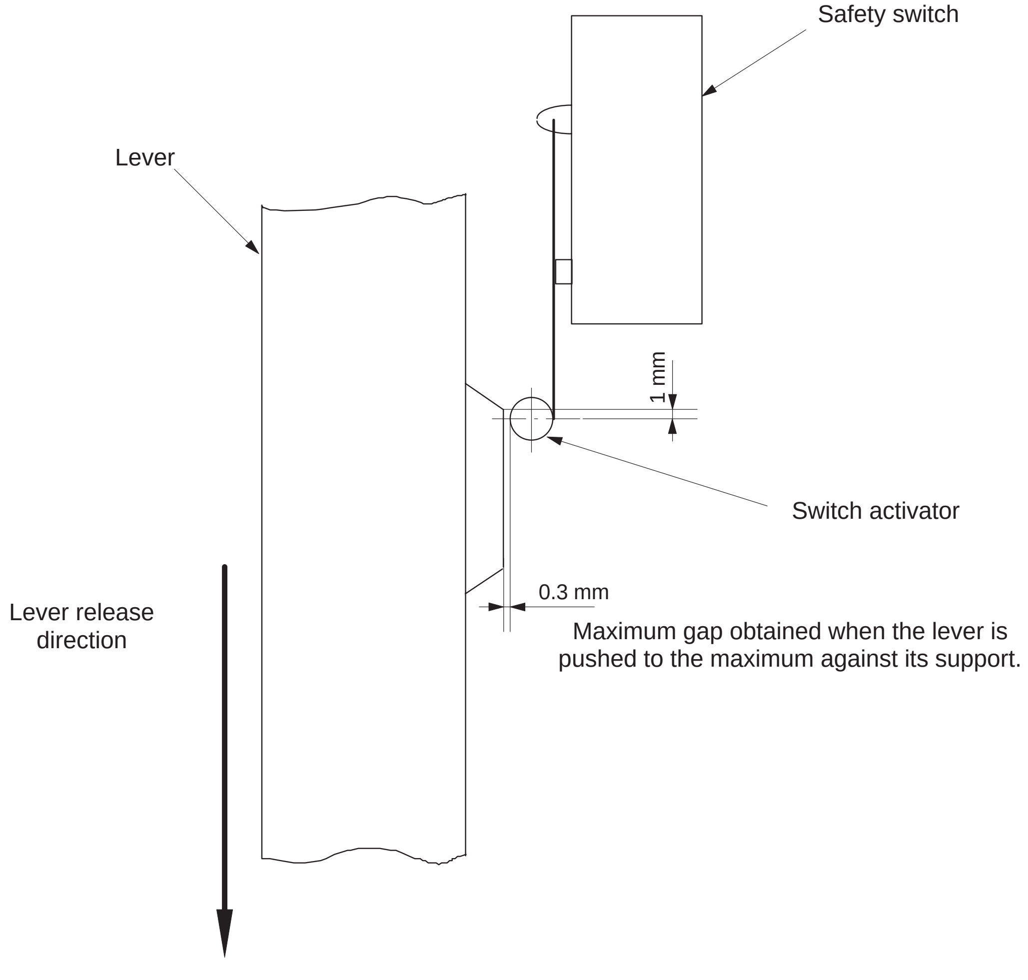


CHECK & ADJUSTMENT OF ELEVATOR SAFETY SWITCH — Job Card CAL 026 — 4 of 4

5.2 Safety Switch Adjustment

1. Place the column carriage in its lowest position.
2. Adjust the microswitch support by placing a 0.3-mm shim between the microswitch roller and the switch activator on the lever (see Ill. 3).
3. Position the roller so that its axis is 1 mm inside the edge of the switch activator (see Ill. 3).

ILLUSTRATION 12
SWITCH ACTIVATOR POSITION



Senographe 700T and 800T Job Card CAL 050

Purpose: **A0 OPTIMIZATION FOR THE CONTACT MODE**	Version No.: A Date: March 15, 2001
Time: x h xx min	Personnel: 1

SECTION 1
PURPOSE

This procedure applies to the 700T/800T Senographes equiped with the “CAL007 9–parameter software”, i.e., a software version higher or equal to V2.31.
The standard adjustment made using Job cards CAL007B and CAL013B guarantees an acceptable Optical Density variation for each Track/Filter combination.
The two purposes of this additional Job Card CAL050 are the following:
1) to check the Optical Density variation for a plexiglass thickness varying from 2 to 6 cm,
2) to reduce the Optical Density variations when switching from one combination to another among the two possible (Mo/Mo and Mo/Rh), and allows to be compliant with the specifications of MQSA 2002 standards (US Regulation). This is achieved by optimizing the value of the coefficient A0 Mo/Rh without screen and with grid coming from CAL007B calibration, the Mo/Mo combination being taken as reference.

SECTION 2
WHERE/WHEN

<u>1) For already installed systems – with the 9–parameter software:</u>

Where

In the countries where MQSA 2002 has become a requirement,
For the other countries if you need to reduce the Optical Density variation

When

This procedure should be performed once for each Film/Screen combination.
It must be repeated each time Job Card CAL007B, CAL013B or CAL014B are redone, for example when the user introduces a new Film /Screen combination

<u>2) For new system installation with the 9–parameter software:</u>

Where

This procedure should be performed in all countries

When

This procedure should be performed once for each Film/Screen combination during the first installation of the system (refer to the “flowchart of AEC/AOP calibration”).

It must be repeated each time Job Card CAL007B, CAL013B or CAL014B is redone, for example when the user introduces a new Film /Screen combination

SECTION 3
PROCEDURE

For 800T: – Copy the 2295753_200_**800T**_CAL50_8_OD_OPTIMIZATION.xls file from the CD 2295753–200 onto your PC hard disk, then run the file from the hard disk. Follow instruction given in the .xls file.

For 700T: – Copy the 2295753_200_**700T**_CAL50_7_OD_OPTIMIZATION.xls file from the CD 2295753–200 onto your PC hard disk, then run the file from the hard disk. Follow instruction given in the .xls file

Note: If you are not provided with Excel*, all necessary formulas are included in the 2295753_200_**800T**_CAL50_8_OD_OPTIMIZATION.pdf file for 800T and 2295753_200_**700T_**CAL50_7_OD_OPTIMIZATION.pdf file for 700T.

*Excel is a registered Trade–Mark of Microsoft Corporation.

Senographe 700T and 800T Job Card CAL 051 1 of 2

Purpose: **A0 OPTIMIZATION FOR THE MAGNIFICATION MODE**	Version No.: A Date: March 15, 2001
Time: x h xx min	Personnel: 1

SECTION 1
PURPOSE

This procedure applies to the 800T Senographe equiped with the “CAL007 9–parameter software”, i.e., **a software version higher or equal to V2.31**.
The standard adjustment made using Job Cards CAL007B and CAL013B guarantees an acceptable Optical Density variation for each Track/Filter combination.
The goal of this additional Job Card CAL051 is to reduce the Optical Density variations when switching from one combination to another among the two possible (Mo/Mo and Mo/Rh) **inside the Magnification Mode**, and allows to be compliant with the specifications of IEC standard.
This procedure **does not reduce** the Optical Density shift between the contact mode and the magnification mode.
This is achieved by optimizing the value of the coefficient A0 Mo/Rh **without** screen and **without** grid (**magnification mode**) coming from CAL007B calibration, the Mo/Mo combination being taken as reference.

SECTION 2
WHERE/WHEN

Where

In the countries where IEC standard has become a requirement,
For the other countries if you need to reduce the Optical Density variation between Mo/Mo and Mo/Rh **inside the magnification mode.**

When

It must be repeated each time Job Card CAL007B, CAL013B or CAL014B is/are redone, for example when the user introduces a new Film /Screen combination

CALIBRATION

A0 OPTIMIZATION
FOR THE MAGNIFICATION MODE

Job Card CAL 051

SECTION 3
PROCEDURE

For 800T: – Copy the 2295753_200_**800T**_CAL51_8_OD_OPTIMIZATION.xls file from the CD 2295753–200 onto your PC hard disk, then run the file from the hard disk. Follow instruction given in the .xls file.

Note: If you are not provided with Excel*, all necessary formulas are included in the 2295753_200_**800T**_CAL51_8_OD_OPTIMIZATION.pdf file.

*Excel is a registered Trade–Mark of Microsoft Corporation.

CHAPTER 4 – DISASSEMBLY/RE-ASSEMBLY

SECTION 1
DISASSEMBLY/RE-ASSEMBLY JOB CARDS

JOB CARD No.	PURPOSE
DR 001	REMOVING & RE-INSTALLING THE CABINET COVERS
DR 002	DISASSEMBLY & RE-ASSEMBLY OF THE MAINS (AC SUPPLY) FILTER
DR 003	DISASSEMBLY & RE-ASSEMBLY OF THE HV TANK
DR 004	DISASSEMBLY & RE-ASSEMBLY OF THE RAM BACK-UP BATTERY
DR 005	REMOVING & RE-INSTALLING THE COVER OF THE COLUMN
DR 006	DISASSEMBLY & RE-ASSEMBLY OF THE ELEVATOR DRIVE-MOTOR
DR 007	DISASSEMBLY & RE-ASSEMBLY OF THE COUNTERWEIGHT BELTS
DR 008	DISASSEMBLY & RE-ASSEMBLY OF THE ANGULAR POSITION POTENTIOMETER
DR 009	DISASSEMBLY & RE-ASSEMBLY OF THE ARM ROTATION BRAKE
DR 010	DISASSEMBLY & RE-ASSEMBLY OF THE EMERGENCY STOP BUTTON
DR 011	REMOVING & RE-INSTALLING THE TUBE COVERS
DR 012	DISASSEMBLY & RE-ASSEMBLY OF THE FILTER ASSEMBLY
DR 013	DISASSEMBLY & RE-ASSEMBLY OF THE X-RAY TUBE
DR 014	DISASSEMBLY & RE-ASSEMBLY OF THE HALOGEN LAMP
DR 015	DISASSEMBLY & RE-ASSEMBLY OF THE MIRROR ASSEMBLY
DR 016	DISASSEMBLY & RE-ASSEMBLY OF THE 200PL2 COLLIMATOR DETECTION BOARD
DR 017	REMOVING & RE-INSTALLING THE EXAMINATION ARM COVERS
DR 018	DISASSEMBLY & RE-ASSEMBLY OF THE COMPRESSION MOTOR ASSEMBLY
DR 019	DISASSEMBLY & RE-ASSEMBLY OF THE EXAMINATION ARM MAIN BELT TOOTH
DR 020	DISASSEMBLY & RE-ASSEMBLY OF THE THICKNESS POTENTIOMETER ASSEMBLY
DR 021	DISASSEMBLY & RE-ASSEMBLY OF THE 200PL7 COMPRESSION SENSOR BOARD
DR 022	DISASSEMBLY & RE-ASSEMBLY OF THE ENCODER WHEEL ASSEMBLY AND 200PL8 ENCODER BOARD
DR 023	DISASSEMBLY & RE-ASSEMBLY OF THE 200PL6 MAGNIFICATION BOAR
DR 024	DISASSEMBLY & RE-ASSEMBLY OF THE BUCKY GRID 18X24 & 24X30
DR 025	DISASSEMBLY & RE-ASSEMBLY OF THE CONDUIT CABLE
DR 026	DISASSEMBLY & RE-ASSEMBLY OF THE HANDLE ASSEMBLIES
DR 027	BOARD CALIBRATION

JOB CARD No.	PURPOSE
DR 028	DISASSEMBLY & RE-ASSEMBLY OF THE PROTECTIVE GLASS
DR 029	DISASSEMBLY & RE-ASSEMBLY OF THE WIRED LED PANEL MOUNT INDICATOR
DR 030	DISASSEMBLY & RE-ASSEMBLY OF THE 300PL9 POWER SUPPLY BOARD, DIODE BRIDGE AND RESISTOR 100R
DR 031	DISASSEMBLY & RE-ASSEMBLY OF THE PHOTOMULTIPLIER TUBE
DR 032	DISASSEMBLY & RE-ASSEMBLY OF THE 200PL5 HTPM BOARD
DR 033	DISASSEMBLY & RE-ASSEMBLY OF THE LOW VOLTAGE POWER SUPPLY ASSEM-BLY

Senographe 700T and 800T — Job Card DR 001

Purpose: **REMOVING & RE-INSTALLING THE CABINET COVERS**	Version No.: Date: Dec. 1995
Time: 10 min	Personnel: 1 field engineer

SECTION 1
SUPPLIES

- None.

SECTION 2
TOOLS

- Enginer’s standard toolkit.

SECTION 3
SPECIAL SAFETY PRECAUTIONS

- None.

SECTION 4
PREREQUISITTES

- None.

REMOVING & RE-INSTALLING THE CABINET COVERS | Job Card DR 001 | 2 of 2

SECTION 5
TASK DESCRIPTION

5.1 Removing the covers

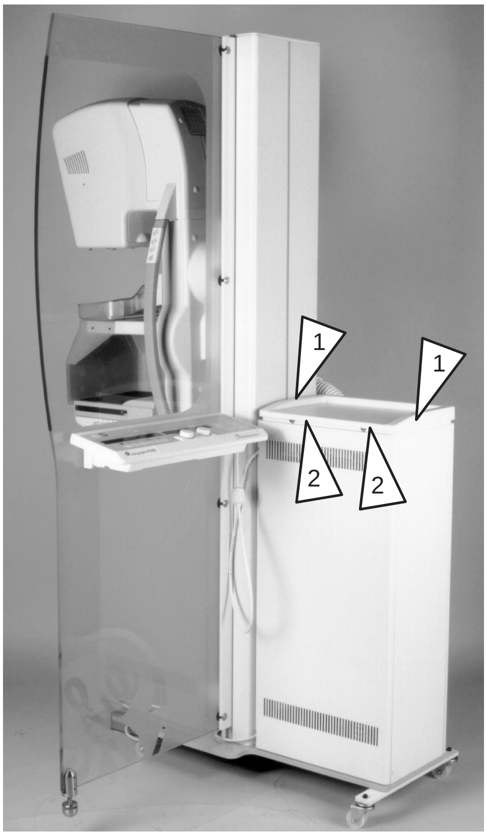
There are three covers on the cabinet – the top cover clips on and the two side covers are held by screws accessible when the top has been removed.

1. To remove the top cover, pull upwards in the areas shown by arrows 1.
2. Undo the two screws (location shown by arrows 2) on each side cover and lift the covers free of their locating pins – disconnect the grounding wires and remove the panels.

5.2 Re-installing the covers

Re-installing the covers is the reverse order of removal.

ILLUSTRATION 1
REMOVING THE COVERS



Senographe 700T and 800T Job Card DR 002

Purpose: **DISASSEMBLY & RE-ASSEMBLY OF THE MAINS (AC SUPPLY) FILTER**	Version No.: Date: Dec. 18, 1995
Time: 0h 50 min	Personnel: 1 field engineer

SECTION 1
SUPPLIES

- Renewal parts AC supply filter.

SECTION 2
TOOLS

- Engineer’s standard toolkit.

SECTION 3
SPECIAL SAFETY PRECAUTIONS

- None.

SECTION 4
PRE-REQUISITES

- DR 001 must be done before this procedure can be started.
- Switch off the Senographe.
- Open the disconnector 300 S1.

DISASSEMBLY & RE-ASSEMBLY OF THE MAINS (AC SUPPLY) FILTER Job Card DR 002

SECTION 5
TASK DESCRIPTION

Left-hand and right-hand sides are defined as being seen from the examination arm (or the patient's) view-point.

5.1 Removing the old filter

1. Referring to in Illustration 1, from the left-hand side of the cabinet:
   – disconnect the AC input and ground cables marked W50 (arrow 1)
   – disconnect the cable marked W16 from XJ4 (arrow 4)
   – disconnect the room and door light cables marked W51 (arrow 2)
   – remove the two nuts (in the area shown by arrow 3) securing the filter to the cabinet floor
   – disconnect the ground wire near arrow 3.
2. Referring to in Illustration 2, from the right-hand side of the cabinet:
   – disconnect the two output cables marked W20 (arrow 1)
   – disconnect the two cables marked 300 S1 (arrow 2)
   – remove the nut (in the area shown by arrow 3) securing the filter to the cabinet floor.
3. Slide the filter assembly out via the right-hand side of the cabinet.

Note: You may need to loosen the HT transformer screw (arrow 4 in Illustration 1) before you can lift the filter over its mounting screws.

5.2 Installing the new filter

Installation of the new filter is the removal procedure in reverse order.

1. Re-install the covers on the cabinet (if necessary refer to DR 001)
2. Re-apply AC power to the Senographe.

DISASSEMBLY & RE-ASSEMBLY OF THE MAINS (AC SUPPLY) FILTER Job Card DR 002 3 of 4

ILLUSTRATION 1
LEFT-HAND SIDE CONNECTIONS TO THE FILTER

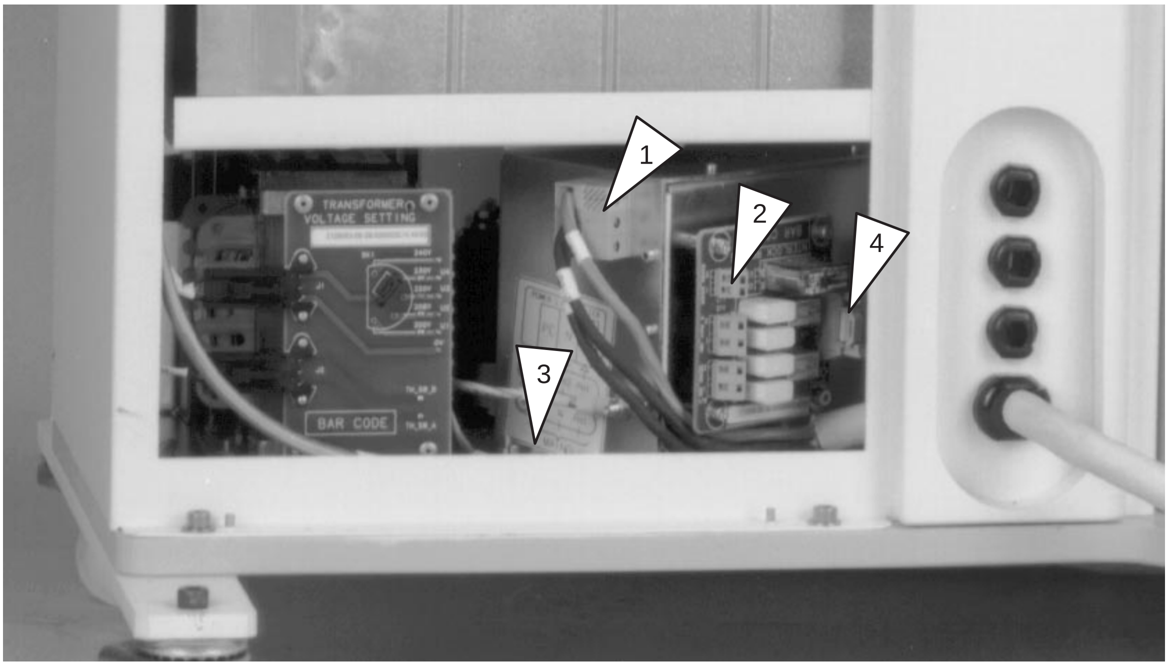
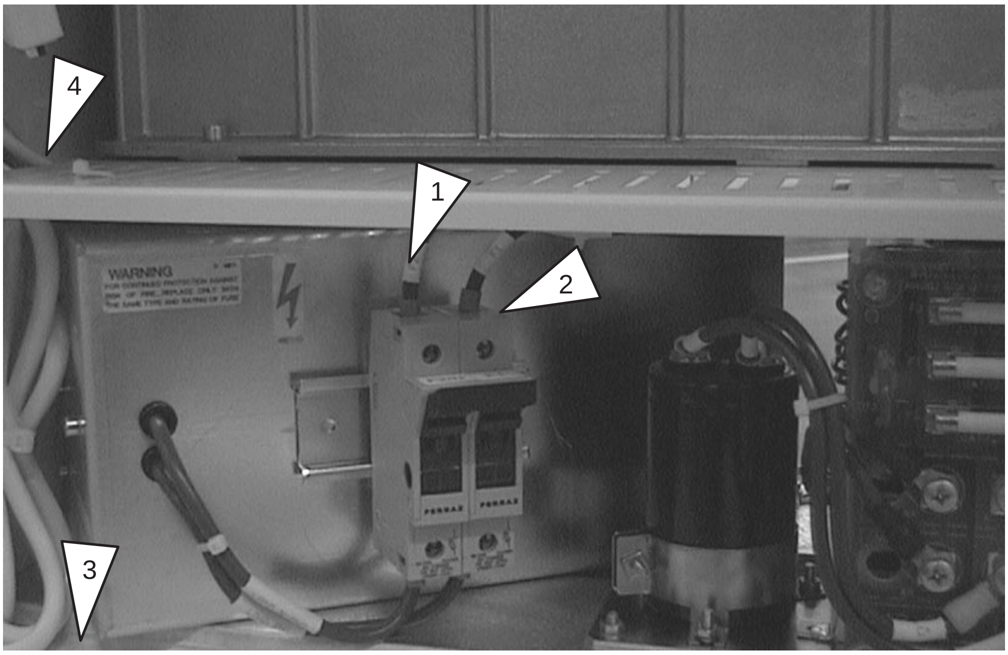


ILLUSTRATION 2
RIGHT-HAND SIDE CONNECTIONS TO THE FILTER



DISASSEMBLY/ RE–ASSEMBLY

DISASSEMBLY & RE-ASSEMBLY OF THE MAINS (AC SUPPLY) FILTER	Job Card DR 002	4 of 4

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Senographe 700T and 800T	Job Card DR 003	1 of 4

Purpose: **DISASSEMBLY & RE-ASSEMBLY OF THE HV TANK**	Version No.: Date: Dec. 18, 1995
Time: 1 hour	Personnel: 1 field engineer

SECTION 1
SUPPLIES

- Renewal part HV tank

SECTION 2
TOOLS

- Engineer's standard toolkit

SECTION 3
SPECIAL SAFETY PRECAUTIONS

- None

SECTION 4
PRE-REQUISITES

- DR 001 must be done before this procedure can be started.
- Switch off the Senographe.
- Open the disconnector 300 S1.

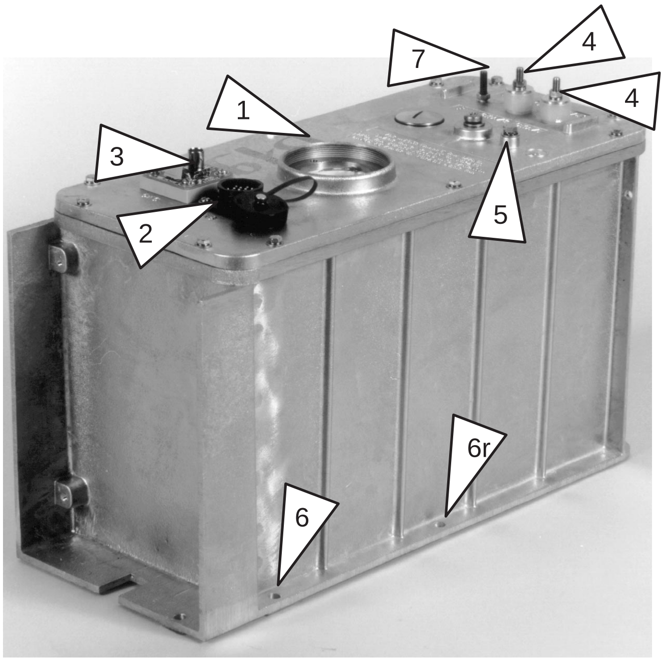
SECTION 5
TASK DESCRIPTION

Left-hand and right-hand sides are as seen from the examination arm (or the patient's) viewpoint.

5.1 Removing the old HV tank (referring to Illustrations 1 & 2)

1. Working on the left-hand side of the cabinet, locate and loosen the small grounding set-screw on the top surface of the locking ring of the HV connector (arrow 1 in Illustration 2).
2. Undo the locking ring and remove the HV connector, positioning it safely out of the way.
3. Disconnect the cable W11 (arrow 2) from GKB.
4. Disconnect the cable W21 (arrow 3) from J1 on the HV measurement board 300PL15.
5. Disconnect the cables W22 (arrow 4) from GKA/1 & GKA/2.
6. Disconnect the ground cables (arrows 5 & 7).
7. Remove the three screws securing the tank to the cabinet – there are 2 on the right-hand side (opposite the arrows 6 & 6r) and 1 on the left-hand side (shown by arrow 6).
8. Cut any cable-ties and move aside any cabling obstructing the exit of the tank via the right-hand side of the cabinet.

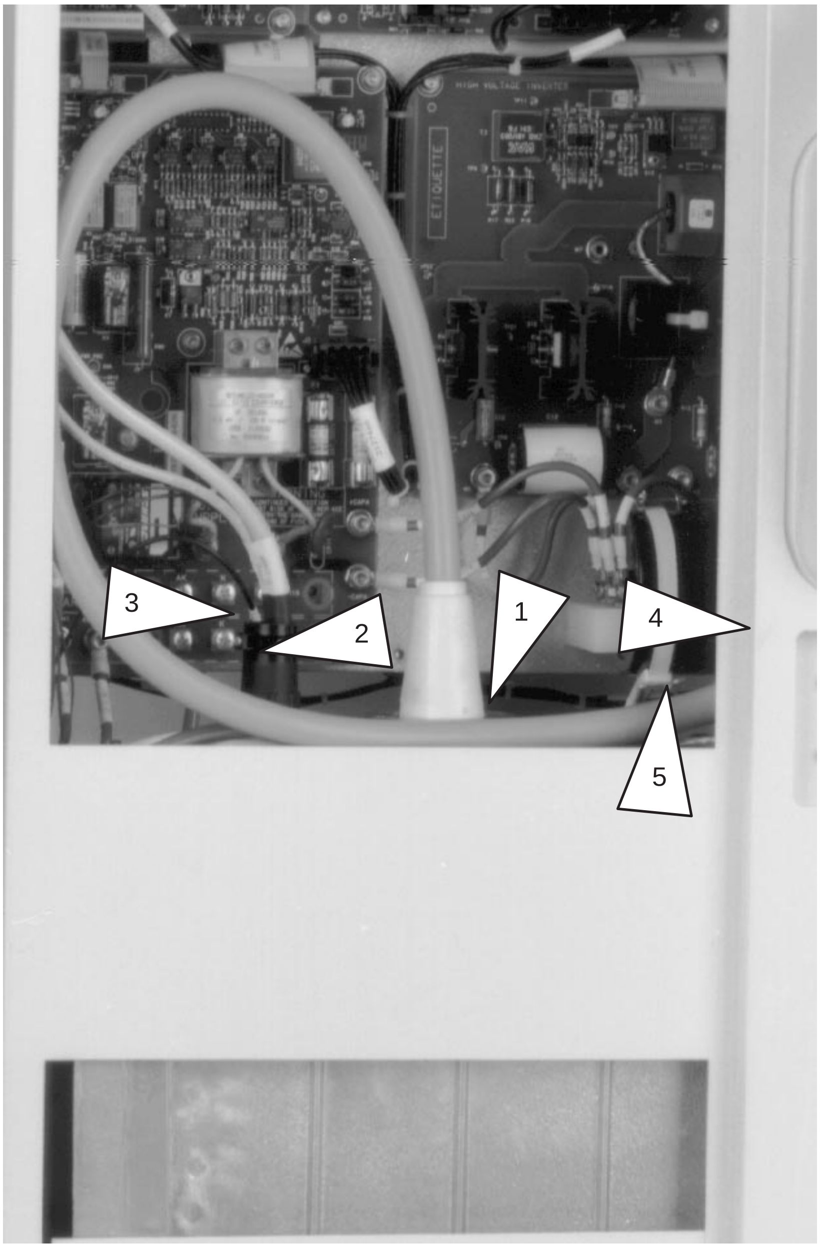
ILLUSTRATION 1
CONNECTIONS TO THE HV TANK



DISASSEMBLY & RE-ASSEMBLY OF THE HV TANK

Job Card DR 003

ILLUSTRATION 2
HIGH VOLTAGE TANK CONNECTIONS



5.2 Installing the new HV tank

1. Installation is the reverse order of the foregoing removal procedure.

DISASSEMBLY & RE-ASSEMBLY OF THE HV TANK

Job Card DR 003

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Senographe 700T and 800T Job Card DR 004

Purpose: **DISASSEMBLING & RE-ASSEMBLING THE RAM BACK-UP BATTERY**	Version No.: Date: Dec. 18, 1995
Time: 45 min	

SECTION 1
SUPPLIES

- Renewal part battery

SECTION 2
TOOLS

- Engineer's standard toolkit

SECTION 3
SPECIAL SAFETY PRECAUTIONS

- None

SECTION 4
PRE-REQUISITES

Note: Before removing the CPU board 300PL4, save the parameters, to ensure that these parameters (which are retained by battery powered RAM) are not accidentally lost while the battery is being changed.

- DR 001 must be done before this procedure can be started.
- Switch off the Senographe.
- Open the disconnector 300 S1.

SECTION 5
TASK DESCRIPTION

5.1 Renewing the battery (referring to Illustration 1)

1. On the right-hand side of cabinet undo the six screws on the panel (arrow 1) and allow it to hinge down.

Note: Use standard ESD precautions (Electrostatic device)

2. On the CPU board 300PL4, undo the five mounting screws and remove the board.
3. Solder the new battery in the empty position beside the old battery (arrow 2).
4. Unsolder the old battery.
5. Re-install the CPU board 300PL4 and secure it with its five screws.
6. Swing up the panel and secure it with its six screws.
7. Re-install the covers on the cabinet (if necessary, refer to DR 001).

5.2 Functional check

1. Switch ON the Senographe power.
2. Check that the message :

   SAVED MEMORY ERROR 071/081

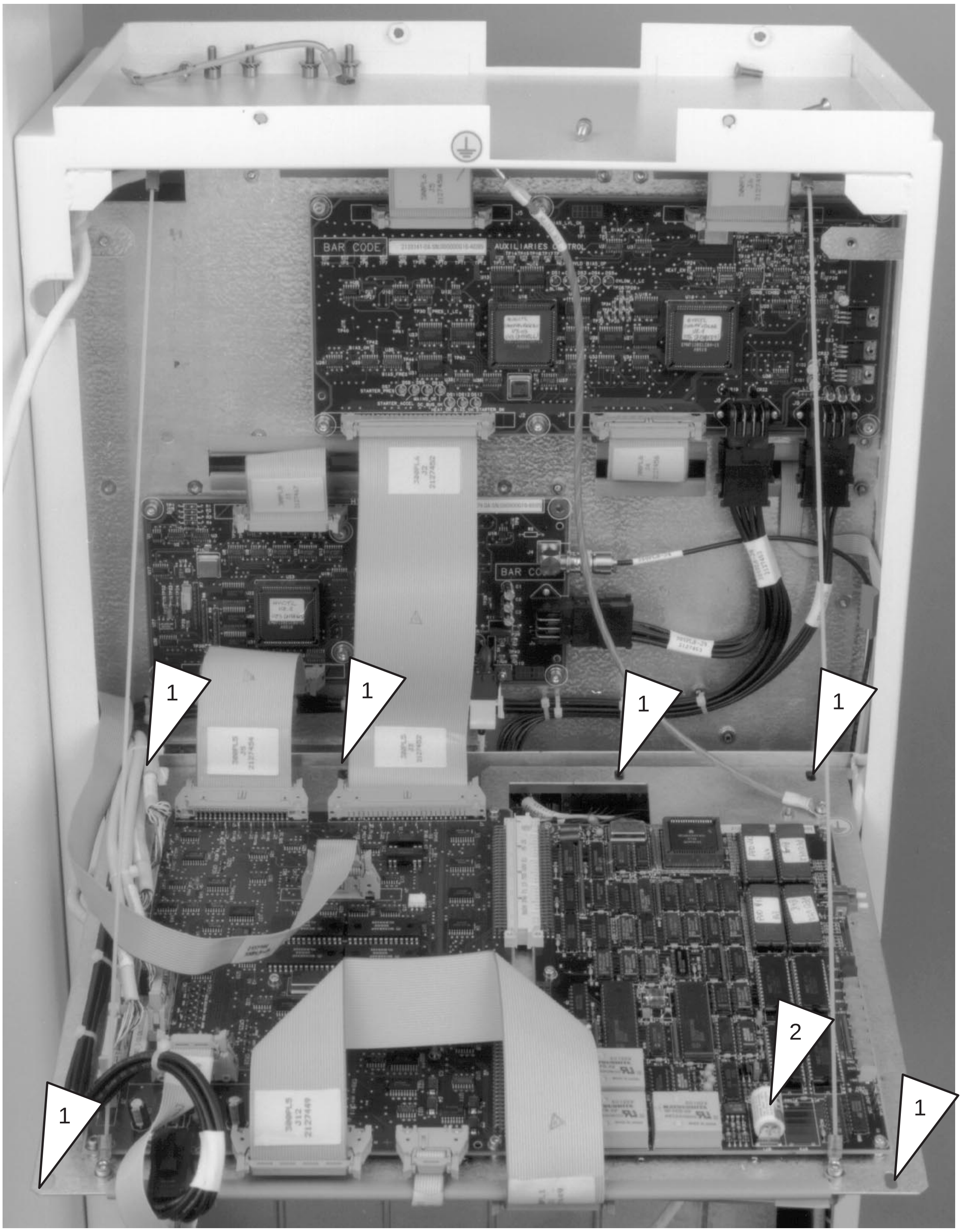
   is not displayed after the initialization sequence has been run.
3. If the above message is displayed, to complete the following steps a calibration backup can be used, or the system can be completely recalibrated following the process in Chapter 3.
4. Repeat step 2.

The Senographe is now operational with the new battery.

DISASSEMBLING & RE-ASSEMBLING THE RAM BACK-UP BATTERY

Job Card DR 004

ILLUSTRATION 1
LOCATION OF THE BATTERY ON THE CPU BOARD



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Senographe 700T and 800T Job Card DR 005

Purpose: **REMOVING & RE-INSTALLING THE COLUMN COVERS**	Version No.: 1 Date: Dec. 18, 1995
Time: 30 min	Personnel: 1 field engineer

SECTION 1
SUPPLIES

- None

SECTION 2
TOOLS

- Engineer’s standard toolkit
- Small step-ladder, or other device suitable for standing on, to work safely at a shoulder height of 2m (6′6″)

SECTION 3
SPECIAL SAFETY PRECAUTIONS

- None

SECTION 4
PRE-REQUISITTES

- Refer to Job Card DR 028 for removal of the protective glass panel when you need to remove the right-hand cover of the column.

REMOVING & RE-INSTALLING THE COLUMN COVERS Job Card DR 005

SECTION 5
TASK DESCRIPTION

Note: To remove the front cover up and out from behind the pivot, the minimum clearance between the top of the Senographe column and any obstruction must be 500mm.

5.1 Removing the front cover (referring to Illustration 1)

1. Lower the arm to its lowest position.
2. Undo the two screws on the top cover (arrow 1) of the column.
3. Lift the cover up so you can disconnect the ground wire and remove the cover.
4. Lift the front cover (arrow 2) upwards and away from the column.

Note: Take care to avoid the grease lubricating the bearing track behind the belts.

5. Re-position the arm to mid-position approximately.
6. Switch off the AC power.
7. Lift the lower part of the front cover to remove the ground wire and the flat cable connections to the display unit (on 800T), then remove the lower cover (arrow 3).

5.2 Removing the left-hand side cover (referring to Illustration 2)

1. In the positions indicated by arrows X, remove two screws on each side cover.
2. On the underside of the cable-conduit support (arrow A in Illustration 1) loosen the set-screw securing the support to its mounting shaft, and then unscrew the shaft from the column.
3. Lift the side cover up to disconnect the ground wire, and then remove the cover to a safe place.

5.3 Removing the right-hand side cover (referring to Illustration 2)

1. Remove the protective glass referring to Job Card DR 028.
2. Remove the four screws (arrows Y) securing the mounting bracket for the protective glass to the right-hand side of the column.
3. Lift the cover sufficiently to disconnect the ground wire, and then remove the right-hand side cover.

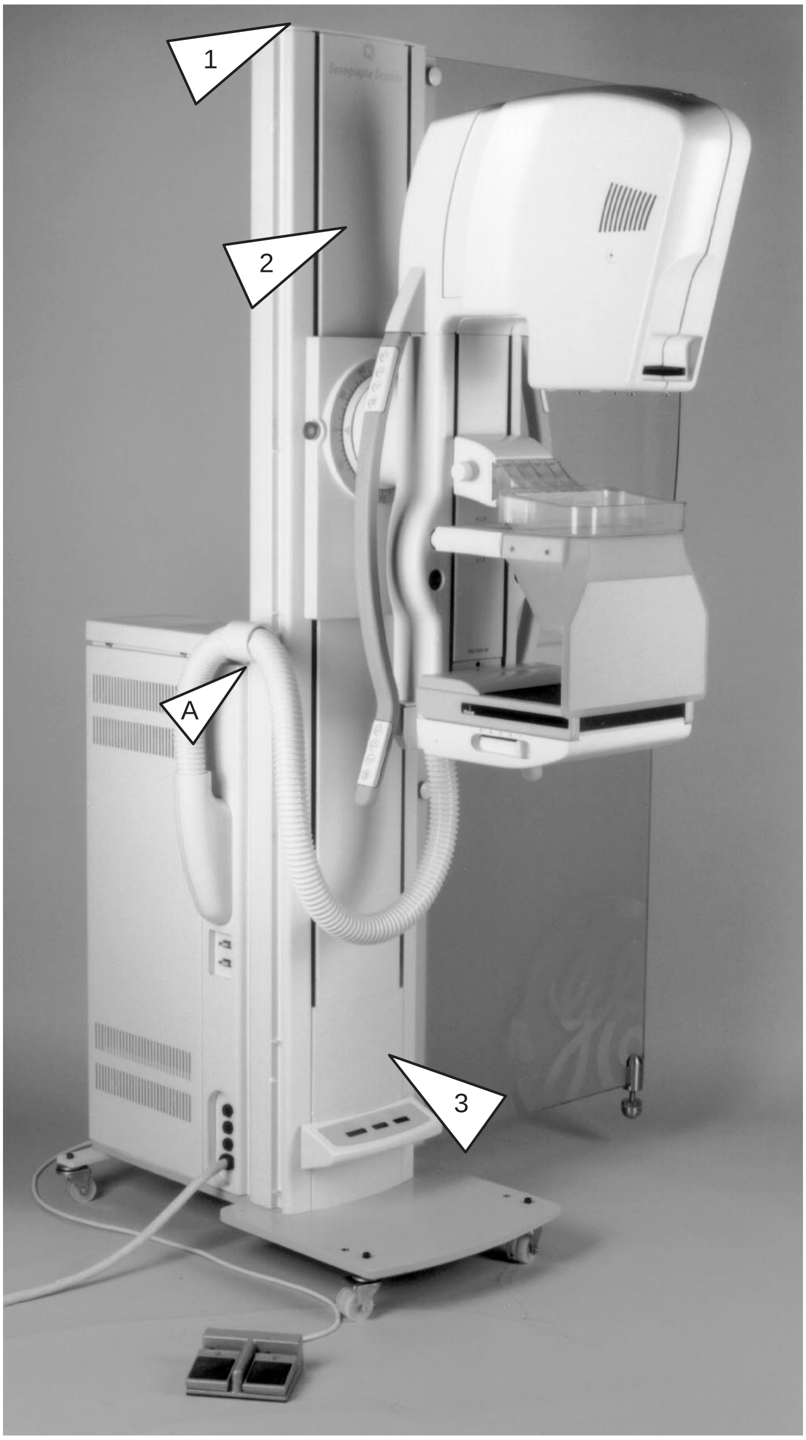
5.4 Re-installing the covers

Note: The top part of the front cover is supported vertically by the lower part (arrow 3 in Illustration 1) – therefore, the lower panel must always be in place before the top part can be re-installed.

Re-installation is the removal procedure in reverse order, and then referring to DR028 for re-installation of the protective glass.

REMOVING & RE-INSTALLING THE COLUMN COVERS	Job Card DR 005	3 of 4

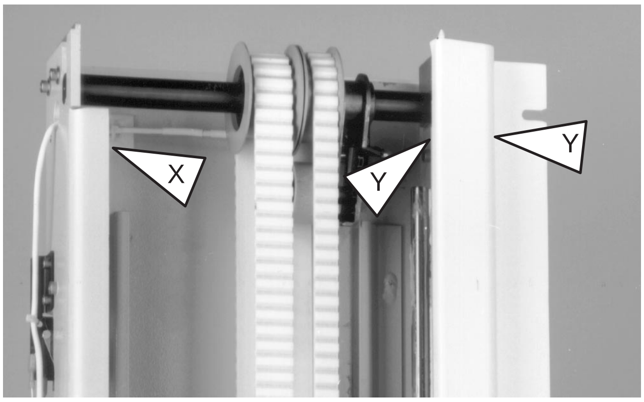
ILLUSTRATION 1
THE COLUMN COVERS

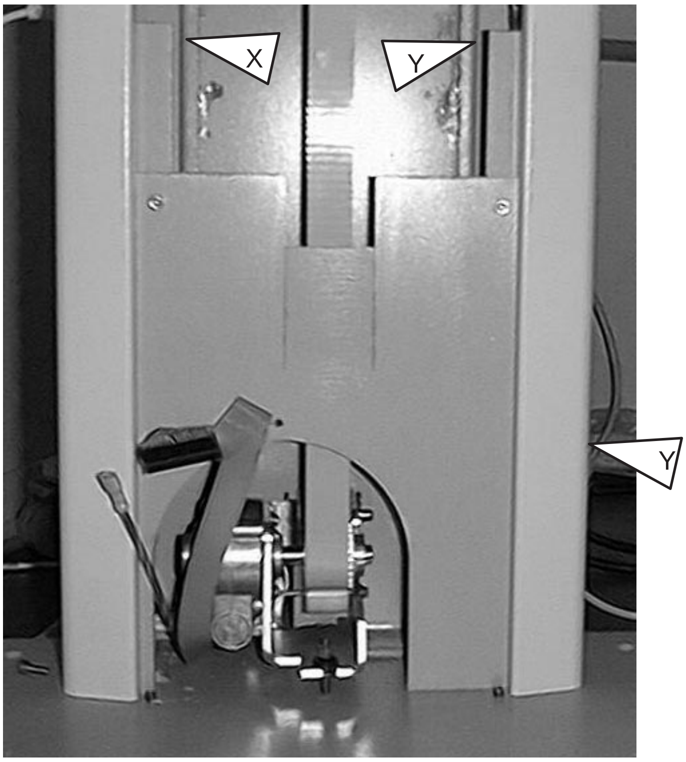


DISASSEMBLY/
RE–ASSEMBLY

REMOVING & RE-INSTALLING THE COLUMN COVERS Job Card DR 005 4 of 4

ILLUSTRATION 2
THE COLUMN SIDE COVER SECURING SCREWS





Senographe 700T and 800T Job Card DR 006

Purpose: **DISASSEMBLY & RE-ASSEMBLY OF THE ELEVATOR DRIVE-MOTOR**	Version No.: Date: Dec. 18, 1995
Time: x h xx min	Personnel: 1 field engineer

SECTION 1
SUPPLIES

- Renewal part motor

SECTION 2
TOOLS

- Engineer’s standard toolkit
- Hand-held flashlight (or other small source of light)

SECTION 3
SPECIAL SAFETY PRECAUTIONS

- None

SECTION 4
PRE-REQUISITES

- DR005 must be done before this procedure can be started.

SECTION 5
TASK DESCRIPTION

Note: Left-hand and right-hand sides are as seen from the examination arm (or the patient’s) viewpoint.

5.1 Removing the old drive-motor (referring to Illustration 2)

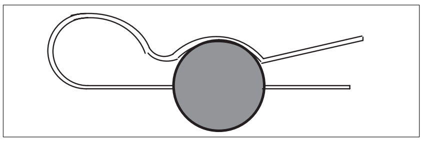
1. If the motor will not turn, go to step 6.
2. Position the arm so that a locking pin can be inserted through the column and the counterweight with the arm near the upper hole in the side of the column.
3. Insert the locking pin and then rotate the arm to about 90°.

4. Switch off the AC power and remove the Bucky from the examination arm.
5. If the motor will turn, now go to step 7.
6. To lock the counter-weight belts, refer to Illustration 1 and, through the holes shown by the arrows, install four M5 screws (in the emergency kit) to a torque of 3 Nm.
7. To release the drive-belt tension, undo and remove the nut and two washers (arrow 1), noting that the smaller washer fits in the countersink of the larger one.
8. Undo the Allen screw (arrow 2) and remove it and the roller (arrow 3).
9. At the rear of the motor, remove the spring-clip from the left-hand side of the pin (arrow 4) and withdraw the pin towards the right-hand side.
10. To disengage the belt from the drive-pulley, slide it under the rim on the right of the pulley.
11. Withdraw the motor far enough to allow you to disconnect it from JP204.

5.2 Installing the new motor

Installing the new motor is the reverse of the above removal procedure.

Note: When re-installing a spring-clip, make sure you do not push it too far onto the pin (the middle of the clip should surround the pin - see sketch below). If you push the pin too far, then the open end of the clip will scrape noisily against either the counterweight or the front panel of the column.



5.3 Belt tension adjustment

The belt tension can only be checked when the examination arm carries all its normal operating equipment (Bucky, cassette, etc.).

1. Place the examination arm at its highest position.
2. At a height of 580mm from the base-plate measure the distance from the back of the column to the front surface of the belt – it should be about 90mm.
3. At the same point, attach one extremity of a dynamometer to the belt and pull to obtain a reading of 3.3 kg +/– 200g.
4. While still pulling, measure the deflection – it should be 30±1mm.
5. If the deflection is outside the limits, adjust the nut (arrow 1 in Illustration 2) until it is correct.

DISASSEMBLY & RE-ASSEMBLY OF THE ELEVATOR DRIVE-MOTOR	Job Card DR 006	3 of 4

ILLUSTRATION 1
LOCKING THE DRIVE-BELTS

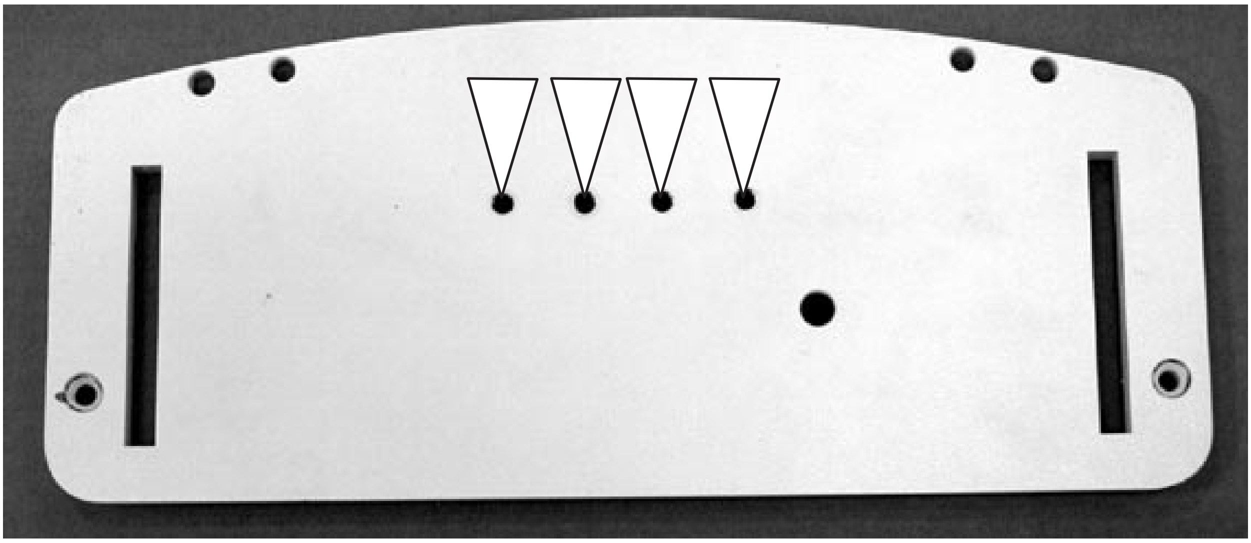
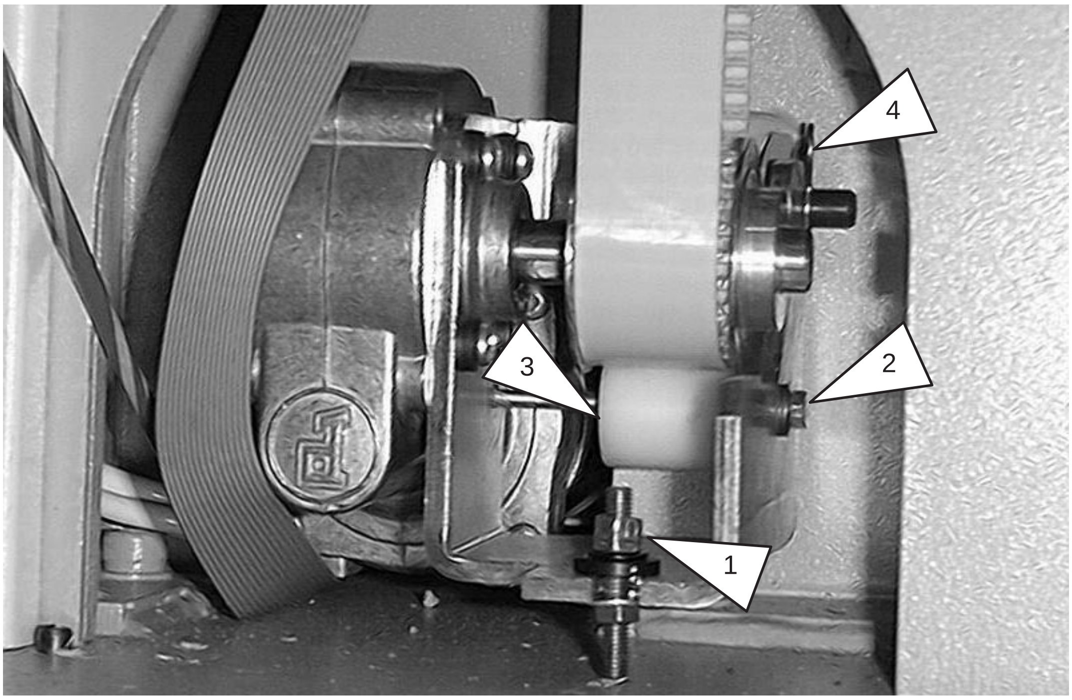


ILLUSTRATION 2
RELEASING THE DRIVE-MOTOR



DISASSEMBLY & RE-ASSEMBLY OF THE ELEVATOR DRIVE-MOTOR

Job Card DR 006

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Senographe 700T and 800T Job Card DR 007

Purpose: **DISASSEMBLY & RE–ASSEMBLY OF THE COUNTERWEIGHT BELTS**	Version No.: Date: Dec. 18, 1995
Time: 1 h 00 min	Personnel: 1 field engineer

SECTION 1
SUPPLIES

- Renewal part drive-belts

SECTION 2
TOOLS

- Engineer's standard toolkit
- Small step-ladder, or other device suitable for standing on, to work safely at a shoulder height of 2m (6′6″)
- M8 $\times$ 200mm threaded rod complete with three M8 nuts (in Emergency maintenance kit)

SECTION 3
SPECIAL SAFETY PRECAUTIONS

- None

SECTION 4
PREREQUISITES

- DR 005 must be done before this procedure can be started

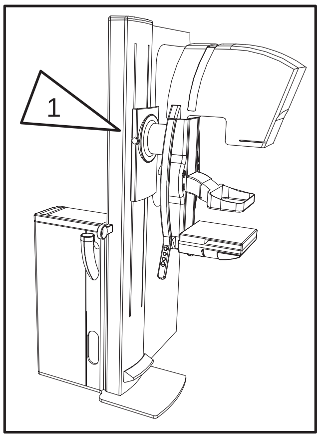
DISASSEMBLY & RE–ASSEMBLY OF THE COUNTERWEIGHT BELTS Job Card DR 007 2 of 6

SECTION 5
TASK DESCRIPTION

5.1 Removing the old belts

1. Locate the locking rod stored in the position shown by arrow 1 in Illustration 1.
2. Position the arm towards its low end-of-travel so that the rod can be inserted through the lower hole (arrow 2) in the side of the column and through the holes in the bottom edge of the counterweight.
3. Switch off the AC power at the main circuit breaker and open the fuse switch.

ILLUSTRATION 1
POSITIONING OF THE LOCKING ROD

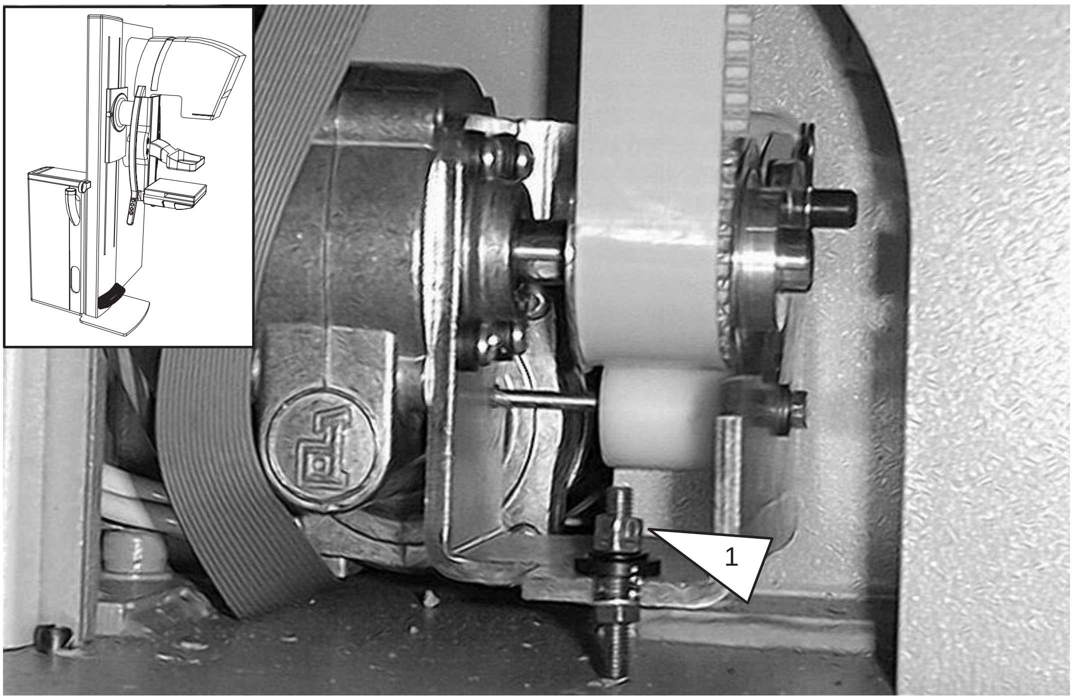


DISASSEMBLY & RE–ASSEMBLY OF THE COUNTERWEIGHT BELTS Job Card DR 007 3 of 6

Referring to Illustration 2

4. To release the drive-belt tension, undo and remove the nut and two washers (arrow 1), noting that the smaller washer fits in the countersink of the larger one.

ILLUSTRATION 2
RELEASING THE DRIVE-BELT TENSION



5. If necessary, switch on the power and move the arm slightly so that the belt is slack at the counterweight end.
6. From the bottom edge of the counterweight, remove one of the spring-clips and remove the pin securing the drive-belt to the counterweight.
7. Re-install the cover on the top of the column (there is no need to install the screws).
8. Insert the 8mm threaded rod in the hole in the middle of the top cover and screw it into the counterweight until it reaches the bottom of the hole in the counterweight.
9. Withdraw the locking rod completely.
10. Continue turning the 8mm screw until the counterweight is pulled up as far as it can go.

Note: Take care to avoid the grease lubricating the bearing track behind the belts.

11. Remove the spring-clip from the right-hand side of the pin at the examination arm end of the counterweight belts.
12. Pull the pin towards the left-hand side of the column to remove it and release the belt tension.
13. Undo the 8mm rod until the counterweight until you can re-insert the locking rod you removed in step 9. above.

DISASSEMBLY/ RE–ASSEMBLY

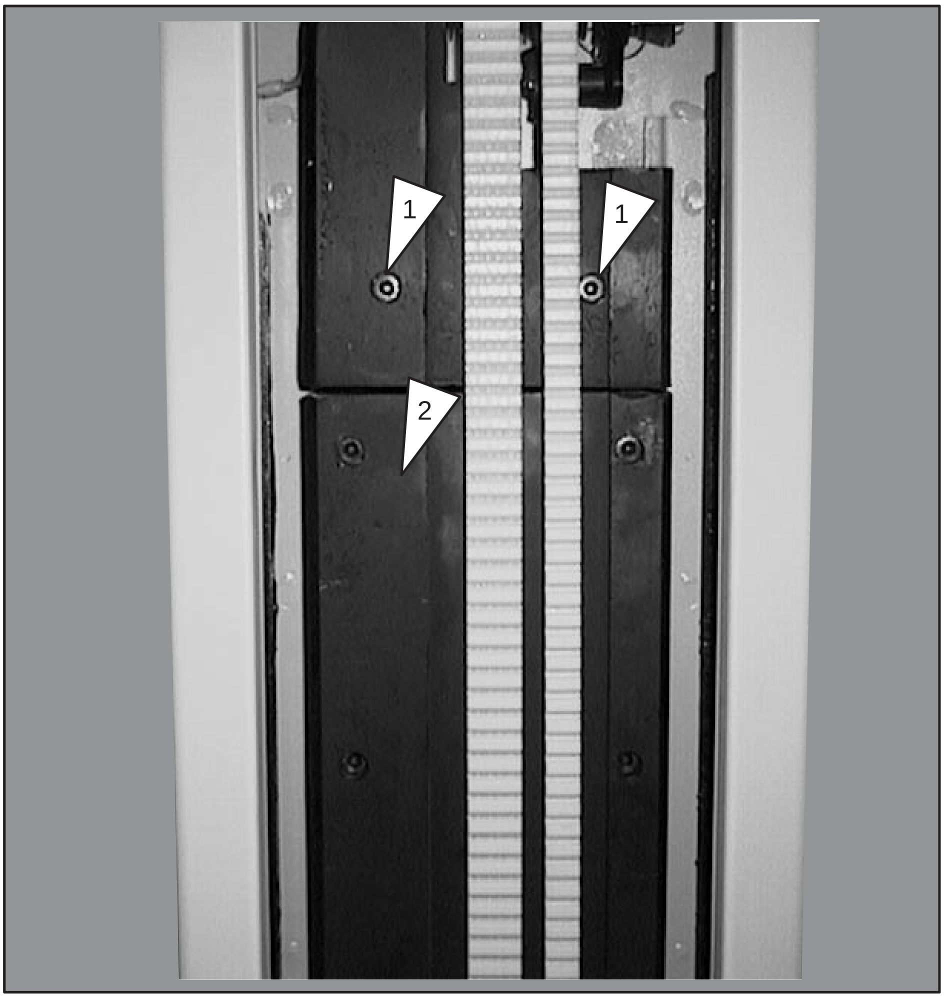
Note: Carefully note the position of the pulley on the narrow security belt (also see Illustration 4).

14. Having inserted the locking rod, continue undoing the 8mm rod until you can raise the front edge of the top cover enough to allow the belts to pass between their pulleys and the top cover.

CAUTION

The portion of the counterweight you will remove in the next step is surprisingly heavy (7kg/15lbs) – take care when removing it.

ILLUSTRATION 3
LOCATION OF UPPER SECURING POINT



15. Undo the two Allen screws (shown by arrows 1 in Illustration 3) and remove the top portion (arrow 2) of the counterweight to a safe place.
16. Undo the four screws in the corners of the belt-securing plate to release the belts from the counterweight.
17. Lift up the front of the top cover and pass the belts over the pulley to remove them from the column.

5.2 Installing the new belts

Installing the new belts is the reverse order of the removal procedure, paying particular attention to correct positioning of the locking switch pulley on the security belt (refer to Illustration 4).

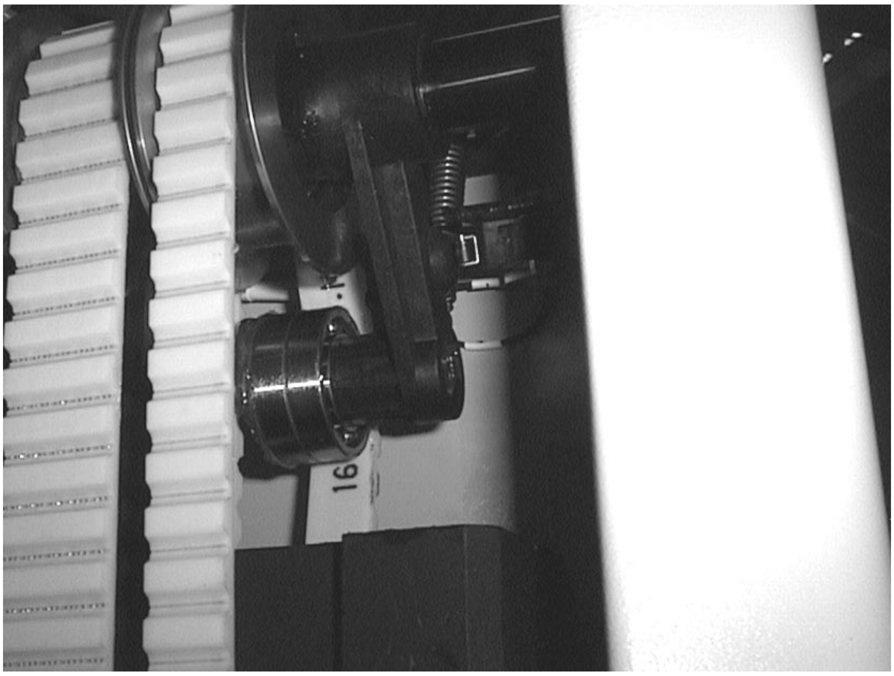
Note: When re-installing a spring-clip, make sure you place it so that the middle of the clip surrounds the pin (see sketch below). If you push the pin too far, then the open end of the clip will scrape noisily against either the counterweight or the front panel of the column.

Refer to DR 006 Section 5.3 for correct adjustment of the belt tension.

5.3 Check and adjustement of the security switch

Perform the jobcard CAL 026 “Check and adjustment of the security switch”.

ILLUSTRATION 4
POSITION OF THE LOCKING PULLEY AND SWITCH



DISASSEMBLY & RE–ASSEMBLY OF THE COUNTERWEIGHT BELTS Job Card DR 007

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Senographe 800T (ONLY)	Job Card DR 008	1 of 4

Purpose: **DISASSEMBLY & RE-ASSEMBLY OF THE ANGULAR POSITION POTENTIOMETER**	Version No.: Date: Dec. 18, 1995
Time: 30 min	Personnel: 1 field engineer

SECTION 1
SUPPLIES

- Renewal part potentiometer

SECTION 2
TOOLS

- Engineer’s standard toolkit

SECTION 3
SPECIAL SAFETY PRECAUTIONS

- None

SECTION 4
PREREQUISITES

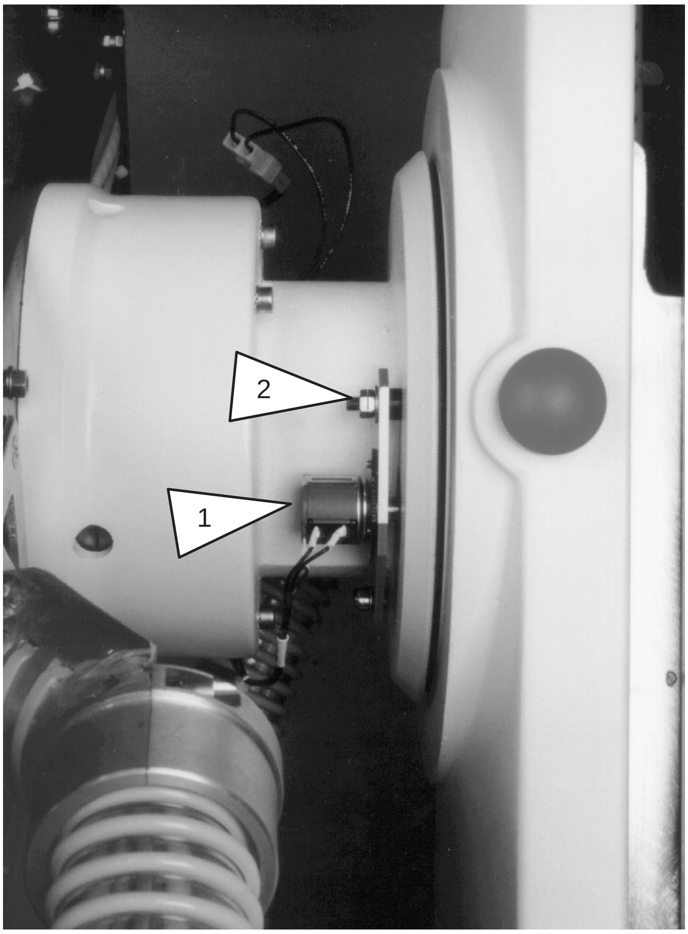
- DR001, DR 011 & DR 017 must be done before you can start this procedure
- Set the examination arm to a comfortable working height.
- Switch OFF the Senographe
- OPEN the disconnector 300 S1

SECTION 5
TASK DESCRIPTION

5.1 Removing the old potentiometer

1. Locate the potentiometer on the pivot (arrow 1 in Illustration 1) and the 200PL9 board on the top of the Examination arm (refer to Illustration 2)
2. Cut, as necessary, the cable-ties along the length of the cable between the potentiometer and connector J4 on the board 200PL9 and disconnect the cable from J4.
3. Undo the 8mm nut (arrow 2 in Illustration 1) securing the potentiometer bracket, loosen the Allen screw holding the potentiometer tensioning spring, and remove the potentiometer assembly.
4. Undo the nut securing the potentiometer to its mounting bracket and remove the potentiometer.

ILLUSTRATION 1
LOCATION OF THE ANGLE POTENTIOMETER



DISASSEMBLY & RE-ASSEMBLY OF THE ANGULAR POSITION POTENTIOMETER Job Card DR 008

5.2 Installing the new potentiometer

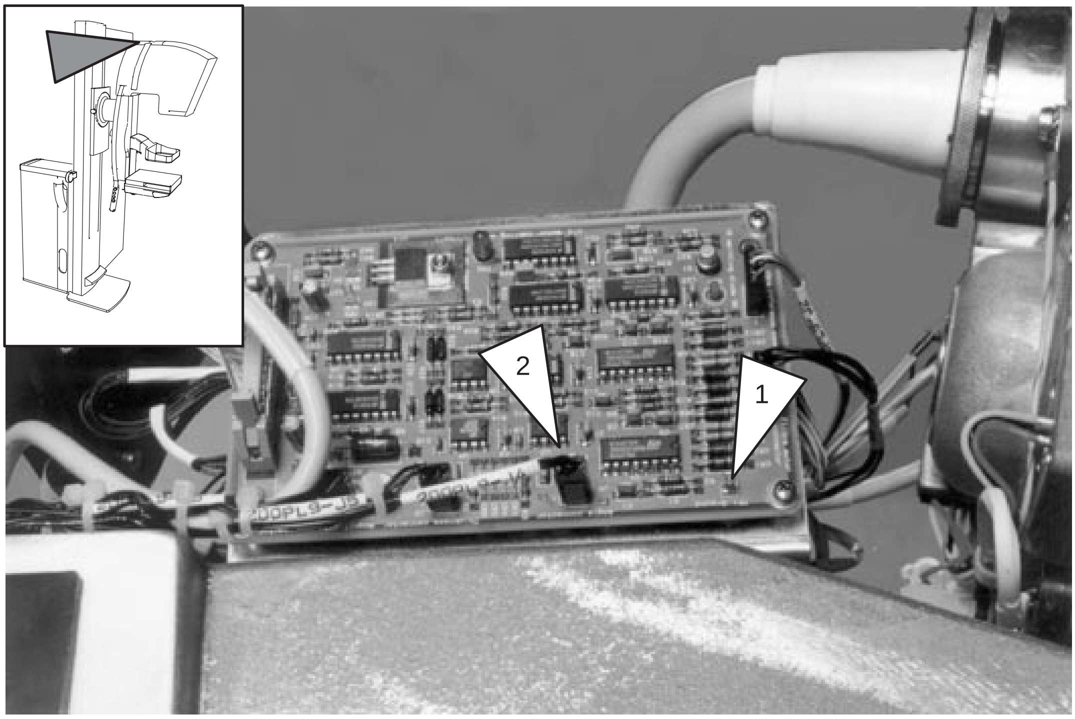
Installation is the reverse order of the removal procedure, but with the following additional steps:

- before mounting the assembly, turn the (10-turn) potentiometer to mid-position approximately
- adjust the tightness of the nut securing the potentiometer bracket so that the spring is controlling the tension applied to the potentiometer.

5.3 Adjusting the position of the potentiometer

1. Apply the AC power to the Senographe and verify that the examination arm is at 0°.
2. Connect a voltmeter between the ground point TP1 (arrow 1 in Illustration 2) and TP2 (arrow 2).
3. If the voltage measured is not 5.0 ± 0.1V DC, you adjust the angular position of the potentiometer by:
   - pulling the potentiometer assembly away from the pivot centre (against the spring tension)
   - then turning the drive wheel on the potentiometer shaft until the voltmeter shows the correct value.

ILLUSTRATION 2
LOCATION OF 200PL9 BOARD AND TP1&2 TEST POINTS



5.4 Functional check

With the potentiometer correctly adjusted, check that the pivot moves over its full range of travel and the angular position shown on the LED display agrees with the marking on the pivot.

If the display does not agree with marking, then you must re-calibrate the potentiometer using Job Card CAL008.

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Senographe 700T and 800T Job Card DR 009

Purpose: **DISASSEMBLY & RE-ASSEMBLY OF THE ARM ROTATION BOX ASSEMBLY**	Version No.: Date: Feb 1995
Time: x h xx min	Personnel: 1 FE + 1 (strong) assistant

SECTION 1
SUPPLIES

- Kit, Part No 2175314

SECTION 2
TOOLS

- Service engineer's standard toolkit

SECTION 3
SPECIAL SAFETY PRECAUTIONS

- This procedure entails removal from the pivot of the complete examination arm assembly, which weighs approximately 60Kg (132lbs). Therefore, be carreful when performing this procedure
- It is ***very important*** for your own safety that you ***strictly observe*** the ***Danger*** notes in Section 6–4. and 6–5.

SECTION 4
PREREQUISITES

- DR001, DR 011 & DR 017 must be done before you can start this procedure
- Set the examination arm to a comfortable working height.
- Switch OFF the Senographe
- OPEN the disconnector 300 S1.

SECTION 5
REMOVING THE COVERS

5.1 Removing the Column Covers

Removal and Reinstallation of Front Cover of Column
(see SM 2146692–100, Job Card DR 005).

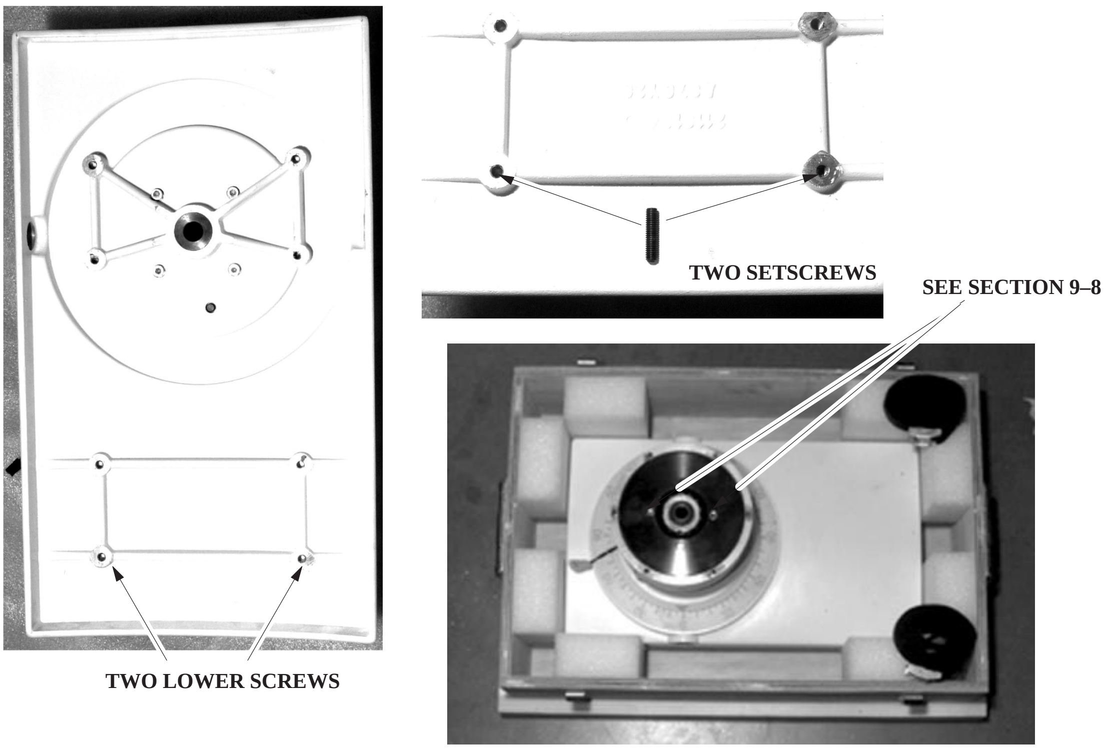
5.2 Removing the Examination Arm Covers

Disassembly and Reassembly of Arm Rotation Brake **(without removing the brake)**.

SECTION 6
POSITIONING THE ARM

1. Remove the two lower screws from the Brake and Rotation Box Assembly (difficult to do once Rotation Arm is at low position) and replace the two setscrews (deliver with the kit) to serve as support (see Ill1) .

ILLUSTRATION 1



DISASSEMBLY & RE-ASSEMBLY OF THE ARM ROTATION BOX ASSEMBLY Job Card DR 009

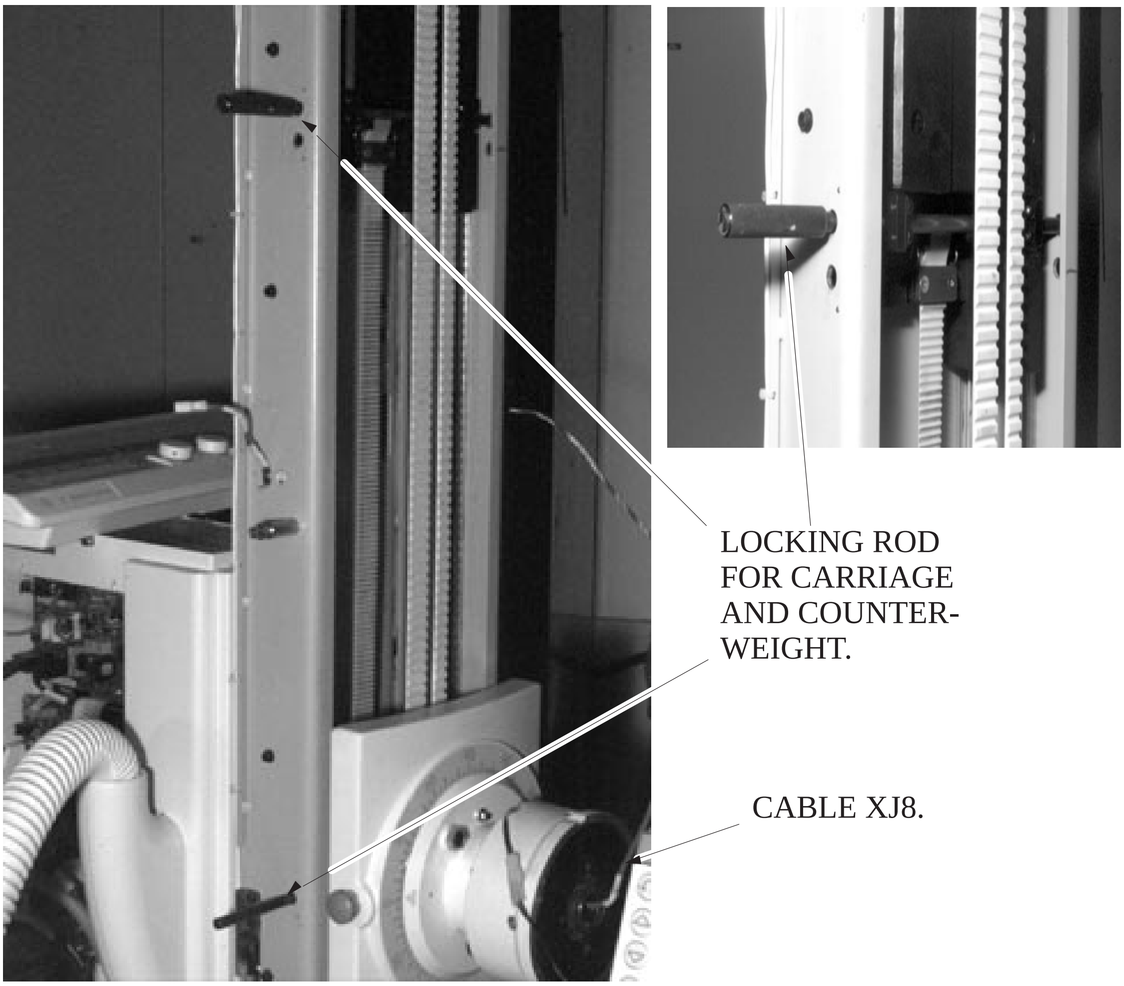
2. Unpack the new Rotation Box Assembly and accessories from the shipping crate (see Ill1).
3. Slide the shipping crate under the image receptor.
4. Lower the arm until it rests on the shipping crate.

CAUTION

DO NOT REMOVE THE ARM BEFORE INSTALLING THE LOCKING ROD

5. Jam the carriage and the counterweight.
6. Turn OFF the Senographe

ILLUSTRATION 2



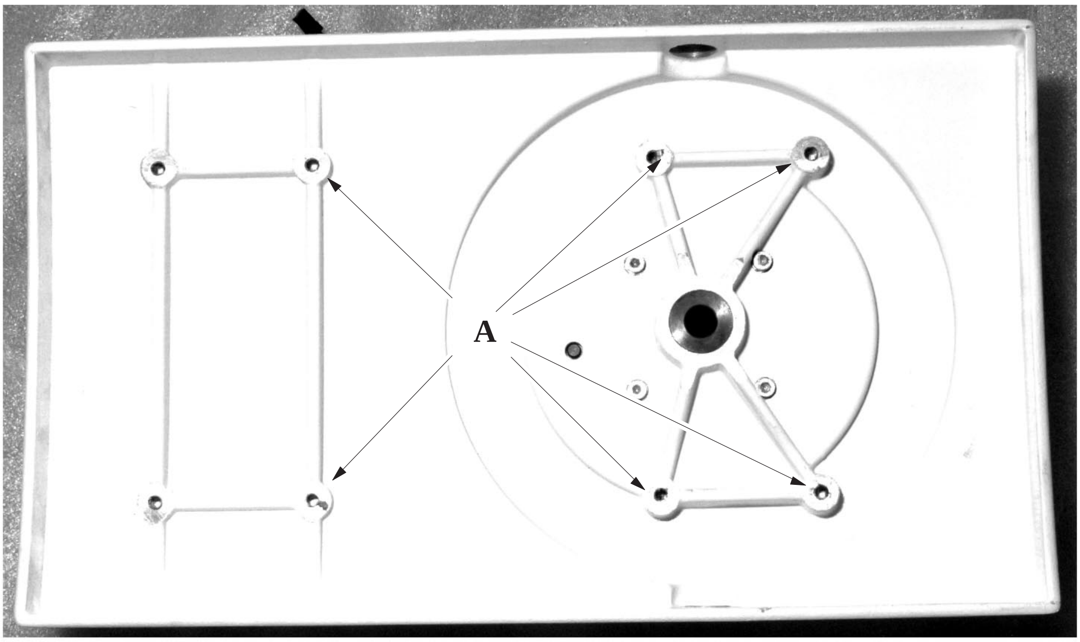
SECTION 7
REMOVING THE ARM

1. Disconnect the cable of the emergency buttons.
2. Disconnect the cable from the brake and from the angular potentiometer (for 800T only).
3. Remove the six screws securing the arm to the Brake and Rotation Box Assembly.
4. Strap the arm to the shipping crate.
5. Move the shipping crate with the Arm to disengage the Brake and Rotation Box Assembly.

SECTION 8
REMOVING THE BRAKE AND ROTATION BOX ASSEMBLY

1. Disconnect the emergency button cables from each side of the Brake and Rotation Box Assembly and Board 200PL1 XJ8.
2. Remove the six screws(see Ill3 Item A) securing the Brake and Rotation Box Assembly, starting with the most inaccessible screw.

ILLUSTRATION 3



3. Remove the Brake and Rotation Box Assembly and carfully guide the cable XJ8 (see Ill 2).

SECTION 9
INSTALLING THE NEW BRAKE AND ROTATION BOX ASSEMBLY

1. Remove the potentiometer (for 800T only) of the old Brake and Rotation Box Assembly as follows:
   e. Remove the screw holding the spring.
   f. Remove the screw supporting the potentiometer.
2. Reinstall the potentiometer (for 800T only) on the new Brake and Rotation Box Assembly.

Note: Using a voltmeter, ensure that the potentiometer is at mid-travel (for 800T only).

3. Install the emergency buttons (supplied in the Kit) on the new Brake and Rotation Box Assembly.
4. Using adhesive tape, secure the emergency stop inside the Brake and Rotation Box Assembly so that the cables are not crushed when the Brake and Rotation Box Assembly makes an Up-movement.
5. Recover the two setscrews from the old Brake and Rotation Box Assembly and install them in the same location in the new Brake and Rotation Box Assembly (see Ill1).
6. Position the new Brake and Rotation Box Assembly assembly on the carriage using the two setscrews as a guide.

WARNING

ENSURE THAT THE EMERGENCY BUTTON CABLES ARE NOT CRUSHED.

7. Reconnect the emergency buttons (cables should route between carriage and interior of Brake and Rotation Box Assembly).
8. Secure the new Brake and Rotation Box Assembly using the six screws (use thread-locking compound and tighten).

Note: **Remove the two screws securing the new Brake and Rotation Box Assembly.**

9. Install two setscrews (supplied in the emergency kit or in the installation kit) in the Brake and Rotation Box Assembly to serve as a guide in repositioning the Arm.
10. Slide the shipping crate with the Arm to put it in place using the setscrews as a guide and install the cable XJ8 (see Ill 2).
11. Reinstall the four screws.
12. Remove the two setscrews from the Brake and Rotation Box Assembly, and install the two mounting screws in their place.
13. Connect the emergency stop buttons and the potentiometer and brake.
14. Remove the pins from the Column.

DISASSEMBLY & RE-ASSEMBLY OF THE ARM ROTATION BOX ASSEMBLY Job Card DR 009

WARNING

ENSURE THAT THE BRAKE AND ROTATION BOX ASSEMBLY CARRIAGE AND THE COUNTERWEIGHT DO NOT COLLIDE DURING ARM MOVEMENT.

15. Power up the system, and move the Examination Arm slightly to give access to the two setscrews.
16. Remove the two setscrews, and replace them with the two mounting screws removed previously.
17. Check that the Brake and Rotation Box Assembly brake operates correctly (rotate the Arm through 360 degrees) .
18. Adjust the potentiometer (for 800T only) of the new Brake and Rotation Box Assembly (refer to Procedure in Job Card DR008, SM 2146692–100).
19. Reinstall the covers on Column and Arm.
20. Place the old Brake and Rotation Box Assembly (repairable part) in the shipping case and ship it to GEMS.

Senographe 700T and 800T Job Card DR 010 1 of 2

Purpose: **DISASSEMBLY & RE-ASSEMBLY OF THE EMERGENCY STOP BUTTON**	Version No.: Date: Dec. 18, 1995
Time: 15 min	Personnel: 1 field engineer

SECTION 1
SUPPLIES

- Renewal part stop button assembly

SECTION 2
TOOLS

- Engineer's standard toolkit

SECTION 3
SPECIAL SAFETY PRECAUTIONS

- None

SECTION 4
PRE-REQUISITES

- DR 005 (front cover only) must be done before this procedure can be started

DISASSEMBLY & RE-ASSEMBLY OF THE EMERGENCY STOP BUTTON Job Card DR 010

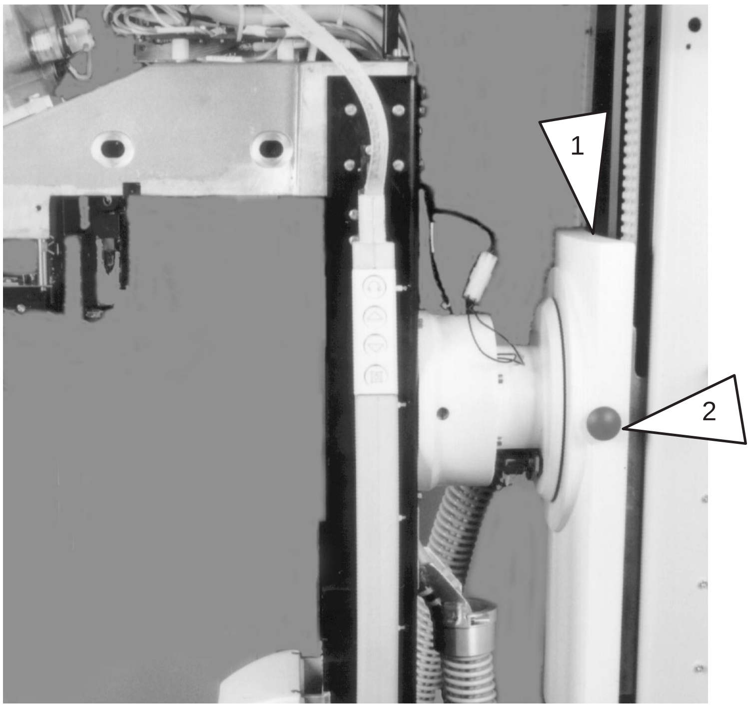
SECTION 5
TASK DESCRIPTION

Note: Left-hand and right-hand sides are as seen from the examination arm (or the patient’s) viewpoint.

5.1 Removing the old switch

1. Disconnect the stop switch at the connector located in the area shown by arrow 1 in Illustration 1.
2. Unscrew the defective stop switch (right-hand switch position shown by arrow 2) in a counter-clockwise direction to remove it.

ILLUSTRATION 1
LOCATION OF EMERGENCY STOP BUTTON



5.2 Installing the new switch

Installation is the reverse order of removal, excepting that you should simultaneously turn the connector and the switch to ensure that the switch cable is not excessively twisted.

Senographe 700T and 800T — Job Card DR 011

Purpose: **REMOVING & RE-INSTALLING THE TUBE HOUSING SPACER COVERS**	Version No.: Date: Dec. 18, 1995
Time: 10 min	Personnel: 1 field engineer

SECTION 1
SUPPLIES

- None

SECTION 2
TOOLS

- Engineer’s standard toolkit

SECTION 3
SPECIAL SAFETY PRECAUTIONS

CAUTION

The maximum operating temperature of the X–RAY Tube is 75° C – therefore, before removing its covers, make sure the X–RAY Tube has cooled down sufficiently to no longer present a hazard.

SECTION 4
PREREQUISITES

- DR001 must be done before you can start this procedure.
- Move the examination arm to a comfortable working height with the arm at about 45°.
- Switch OFF the the Senographe.
- Open the disconnector 300 S1.

SECTION 5
TASK DESCRIPTION

Note: Left-hand and right-hand sides are as seen from the examination arm (or the patient's) viewpoint.

5.1 Removing the covers

The X–RAY Tube covering consists of two large covers screwed together and one small clip-on panel.

1. Pull down on the clip-on panel on the underside of the X–RAY Tube support arm in the area shown by arrow X in Illustration 1 and remove the panel.
2. Remove the blanking caps and remove the four screws at the back of the X–RAY Tube arm in the area shown by arrows 1.
3. Remove the blanking caps and remove the two screws in the area shown by arrow 2.
4. In the areas shown by arrows 3, remove the two **right-hand caps only** and remove the right-hand screw from each position (if you remove both screws at arrow 3 positions, then the securing plate for the screws will fall off).
5. At the point where the covers meet the two handles it is necessary to gently lever away the cover.

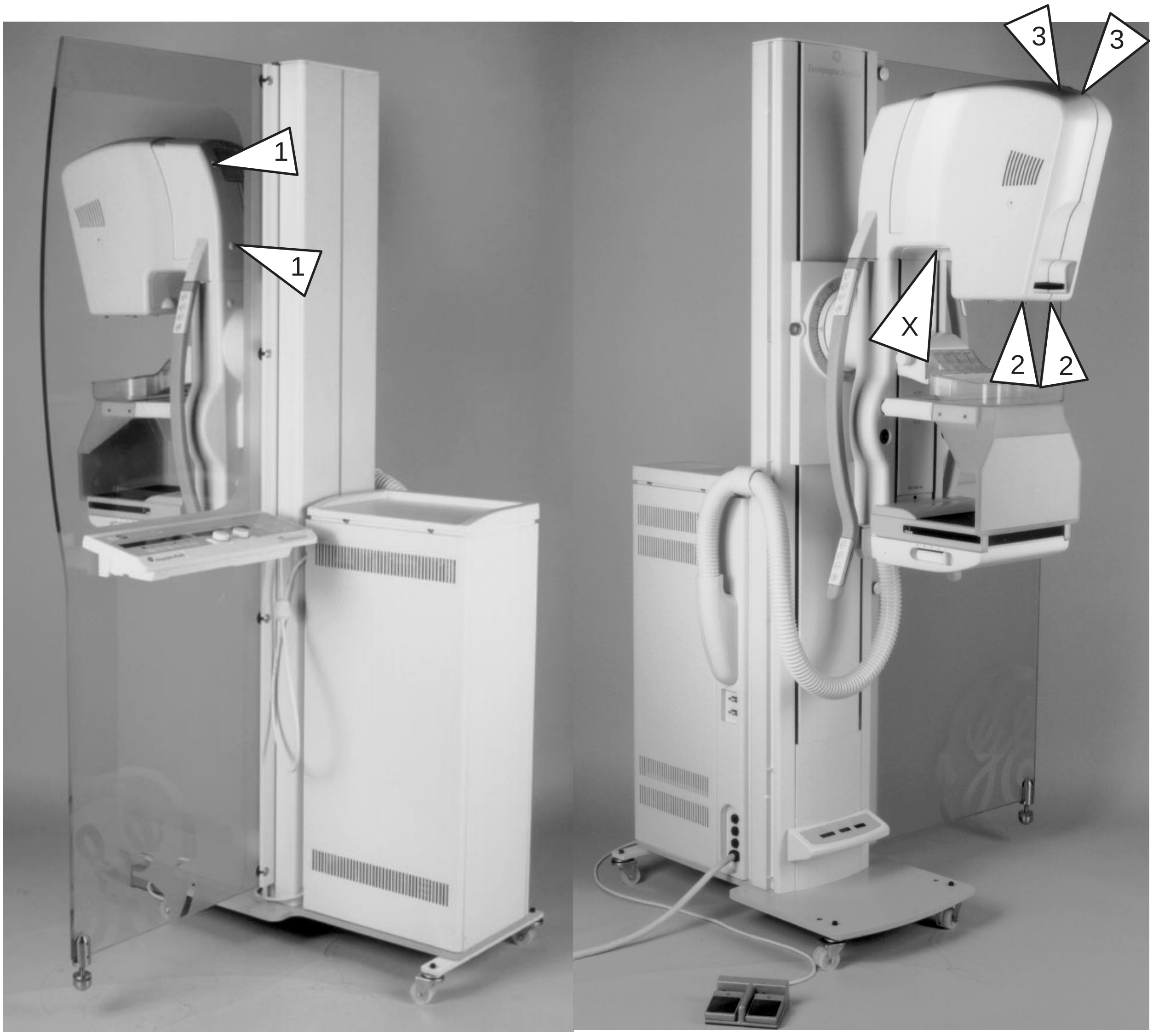
5.2 Re-installing the covers

Re-installing the covers is the reverse order of removal.

REMOVING & RE-INSTALLING THE TUBE HOUSING SPACER COVERS

Job Card DR 011 3 of 4

ILLUSTRATION 1
LOCATION OF THE RETAINING SCREWS



DISASSEMBLY/ RE–ASSEMBLY

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Senographe 800T (ONLY) Job Card DR 012

Purpose: **DISASSEMBLY & RE-ASSEMBLY OF THE FILTER ASSEMBLY**	Version No.: Date: Dec. 18, 1995
Time: 1 hour	Personnel: 1 field engineer

SECTION 1
SUPPLIES

- Renewal part filter wheel.

SECTION 2
TOOLS

- Engineer's standard toolkit.

SECTION 3
SPECIAL SAFETY PRECAUTIONS

CAUTION

The maximun operating temperature of the X–RAY Tube is 75°C – therefore, before working near the X–RAY Tube make sure it has cooled down sufficiently to no longer present a hazard.

- See note concerning handling the filter assembly.

SECTION 4
PREREQUISITES

- DR 011 must be done before you can start this procedure.
- Set the examination arm to a comfortable working height with the X–RAY Tube at about 90°.
- Switch OFF the Senographe.
- Open the disconnector 300 S1.

SECTION 5
TASK DESCRIPTION

Note: Left-hand and right-hand sides are as seen from the examination arm (or the patient's) viewpoint.

5.1 Removing the filter assembly (referring to Illustration 1)

1. Undo four screws and remove the black light-shield around the mirror and centring light assemblies (if necessary refer to DR009 step AUCUN LIEN)
2. Cut the cable-ties securing the cables W214 & W215 along their route to 200PL9 (arrow 1) and disconnect them from J2 & J3.
3. Remove the screw from the left–hand (as you look at it) side of the magnetic buttons plate (arrow 2) and loosen the other screw so you can move the plate to get clear access to the screw underneath (arrow 3).
4. Loosen the filter assembly securing screw (arrow 3) one or two turns, and then remove the other two screws (arrows 4) and lift the filter wheel out via the front of the housing.

5.2 Installing the new filter assembly

CAUTION

The filters are very fragile and must remain clean – therefore, when handling the assembly, make sure you treat the it very carefully and do not touch the filter surfaces with either hard objects or your fingers.

Keeping this caution in mind, installation is the reverse order of the removal procedure.

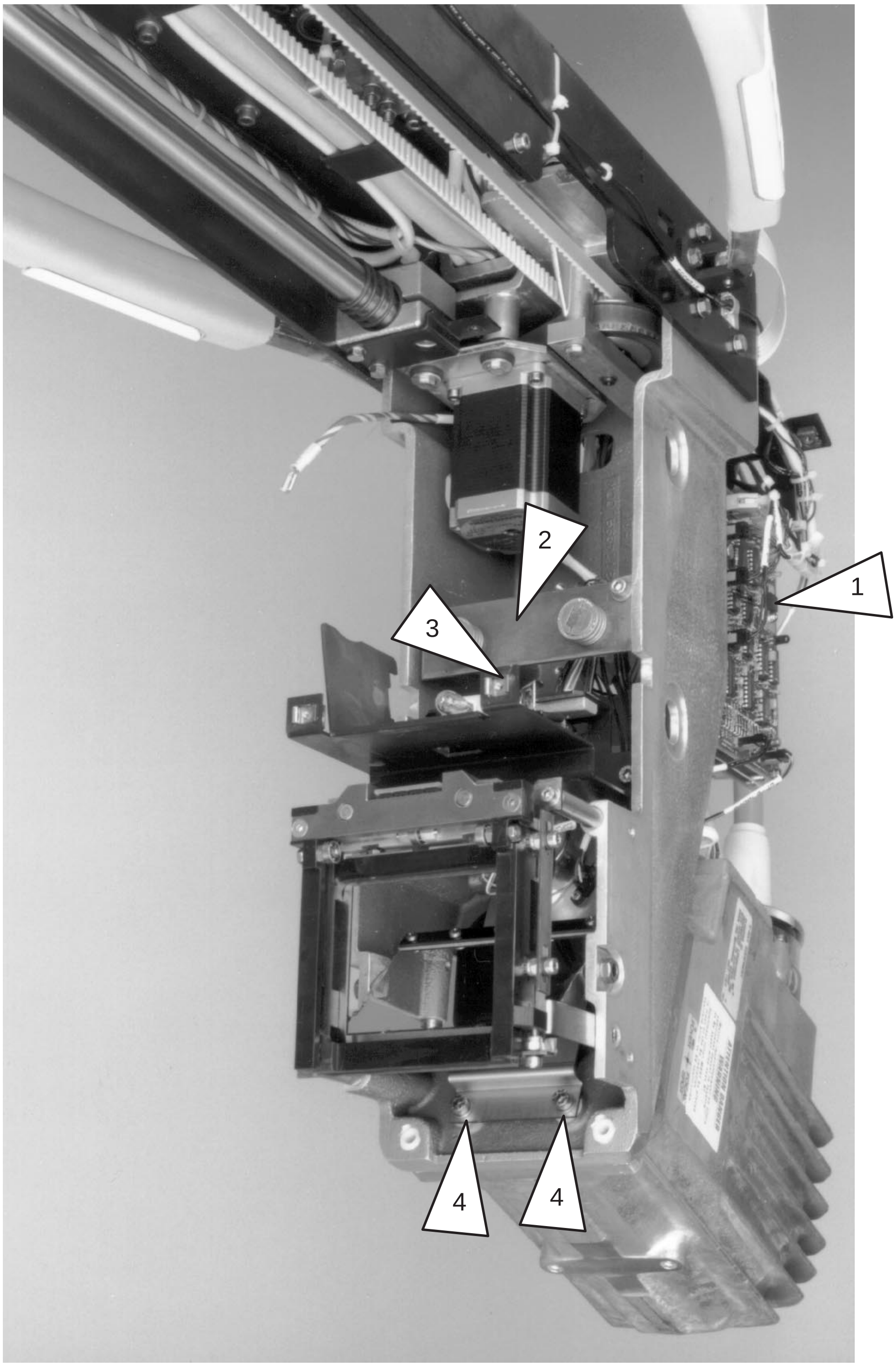
5.3 Functional check

As a consequence of changing the filter assembly you must perform the following Job Cards:

- CAL 007
- CAL 014
- CAL 015
- and if needed, CAL 022

DISASSEMBLY & RE-ASSEMBLY OF THE FILTER ASSEMBLY Job Card DR 012 3 of 4

ILLUSTRATION 1
LOCATION OF THE FILTER WHEEL



DISASSEMBLY & RE-ASSEMBLY OF THE FILTER ASSEMBLY	Job Card DR 012	4 of 4

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Senographe 700T and 800T Job Card DR 013

Purpose: **DISASSEMBLY & RE-ASSEMBLY OF THE X-RAY TUBE**	Version No.: Date: Dec. 18, 1995
Time: 2 h 30 min (including re-calibration)	Personnel: 1 field engineer

SECTION 1
SUPPLIES

- Renewal part X-ray tube

SECTION 2
TOOLS

- Engineer's standard toolkit
- Torque wrench

SECTION 3
SPECIAL SAFETY PRECAUTIONS

CAUTION

The maximum operating temperature of the X-ray tube is 75°C – therefore, before working on it, make sure the X-ray tube has cooled down sufficiently to no longer present a hazard.

SECTION 4
PREREQUISITES

- DR011 must be done before this procedure
- Set the X-ray tube to a comfortable working height in the vertical position
- Switch OFF the Senographe.
- Open the disconnector 300 S1.

DISASSEMBLY & RE-ASSEMBLY OF THE X-RAY TUBE	Job Card DR 013	2 of 4

SECTION 5
TASK DESCRIPTION

5.1 Removing the old X-ray tube (referring to Illustration 1)

1. Open the fuse switch
2. Disconnect the two grounding wires in the position shown by arrow 1.
3. Disconnect the anode return wire marked +HT TUBE (arrow 2).
4. Loosen the set-screw on the surface of the HV connector ring and disconnect the HT cable (arrow 3).
5. Undo the two screws on the connectors and remove the two cables from J1 & J2 (arrow 4).
6. Remove the screw securing the cable clamp on the cables at J1 & J2.
7. Remove the two screws from the front of the X-ray tube.

CAUTION **Do not touch the Berylium tube port – Berylium is a cancer-causing agent.**

8. Keeping a firm grip on the X-ray tube as you undo the second one, loosen by about 2 turns the two X-ray tube securing screws in the areas shown by arrows 5.
9. Carefully lift the X-ray tube vertically off the arm and remove it, noting that there are white plastic shock-absorbers under the four screws and one under the output of the tube itself.

5.2 Installing the new tube

CAUTION **When installing a tube, make sure that the grounding connections are securely tightened – a loose ground connection may permit the tube casing to assume a potentially dangerous voltage level.**

Installing the new tube is the reverse order of removal, but note that the four X-ray tube mounting screws must be tightened with a torque wrench set to 2.5Nm (22 lb fin).

5.3 Functional check

When a new tube has been installed, it will be necessary to perform the following Job Cards in this order:

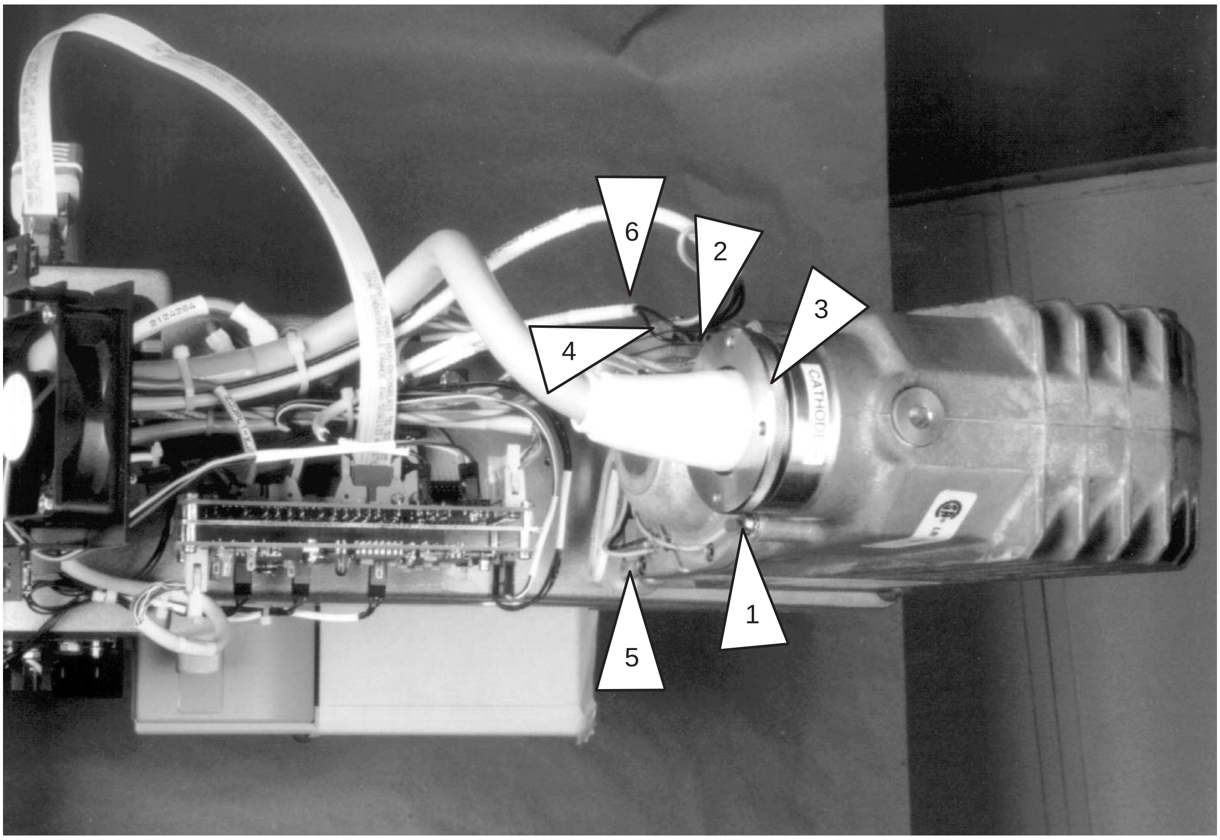
- CAL 002
- CAL 003
- CAL 007
- CAL 014
- CAL 022 (if needed)
- CAL 021
- CAL 025

DISASSEMBLY/
RE–ASSEMBLY

DISASSEMBLY & RE-ASSEMBLY OF THE X-RAY TUBE

Job Card DR 013

ILLUSTRATION 1
X-RAY TUBE CONNECTIONS AND SECURING SCREWS



5.4 CAL 025

DISASSEMBLY & RE-ASSEMBLY OF THE X-RAY TUBE	Job Card DR 013	4 of 4

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Senographe 700T and 800T Job Card DR 014

Purpose: **DISASSEMBLY & RE-ASSEMBLY OF THE HALOGEN LAMP**	Version No.: Date: Dec. 18, 1995
Time: 10 min	Personnel: 1 field engineer

SECTION 1
SUPPLIES

- Renewal part halogen lamp (it is a specially constructed item).

SECTION 2
TOOLS

- Engineer’s standard toolkit.

SECTION 3
SPECIAL SAFETY PRECAUTIONS

- None, but see the caution, on the next page, concerning handling the halogen lamp.

SECTION 4
PRE-REQUISITES

- DR 011 must be done before you can start this procedure.
- Position the examination arm at maximum height.
- Switch OFF the Senographe.
- Open the disconnector 300 S1.

DISASSEMBLY & RE-ASSEMBLY OF THE HALOGEN LAMP — Job Card DR 014

SECTION 5
TASK DESCRIPTION

5.1 Removing the halogen lamp (referring to IIllustration 1)

CAUTION **The lamp may be very hot – therefore, make sure it has been off for about twenty minutes before you start this procedure.**

1. To get access to the lamp, pull down on the clip-on panel on the underside of the tube Housing spacer (see arrow X in insert of Illustration 1).
2. At the two points indicated by arrows 1, pull the hinged flap downwards and turn it away from you (see Illustration 2).
3. To remove the old lamp, press the lever (arrow 1 of Illustration 2) upwards.

5.2 Installing the new lamp

CAUTION **Avoid touching the glass envelope – if you accidently touch it, make sure you wipe it clean with a lint-free cloth moistened with an alchohol cleaning fluid (if you do not clean it, the life of the lamp will be severely shortened).**

Installation of the new lamp is the reverse order of removal.

ILLUSTRATION 1
LOCATION OF THE CENTRING LIGHT (shown with covers removed for clarity)

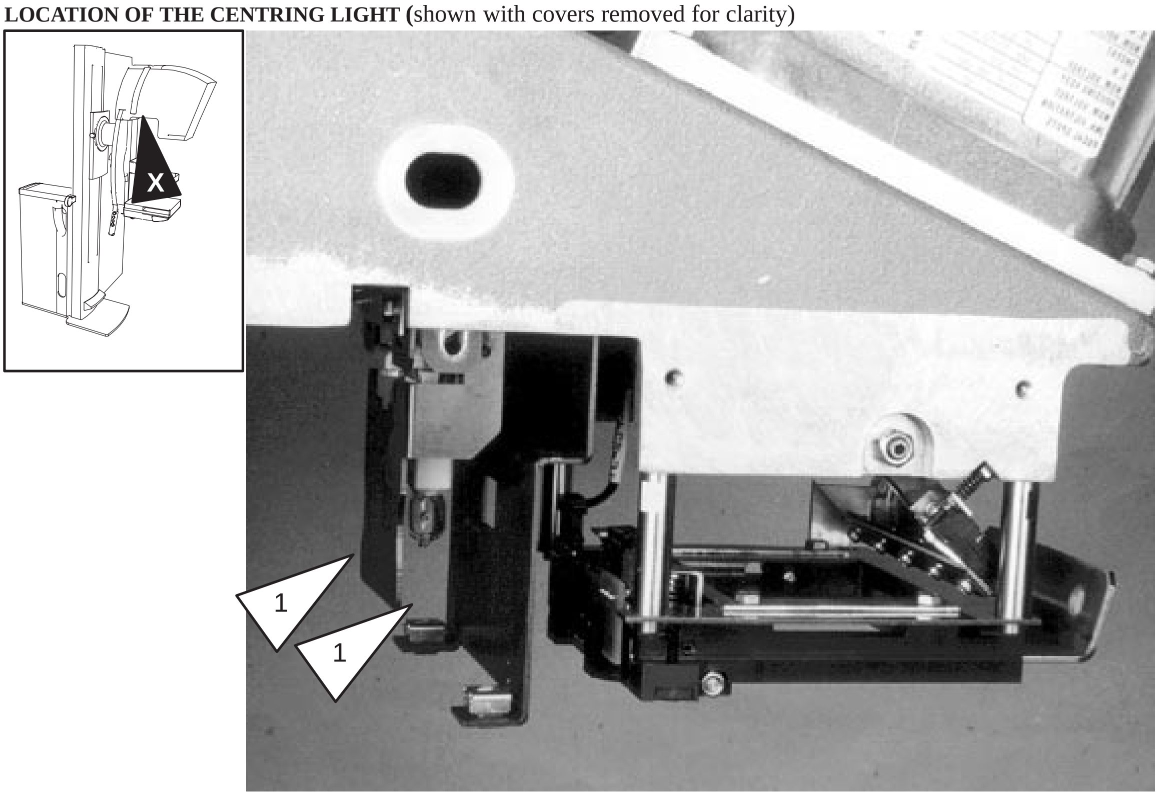
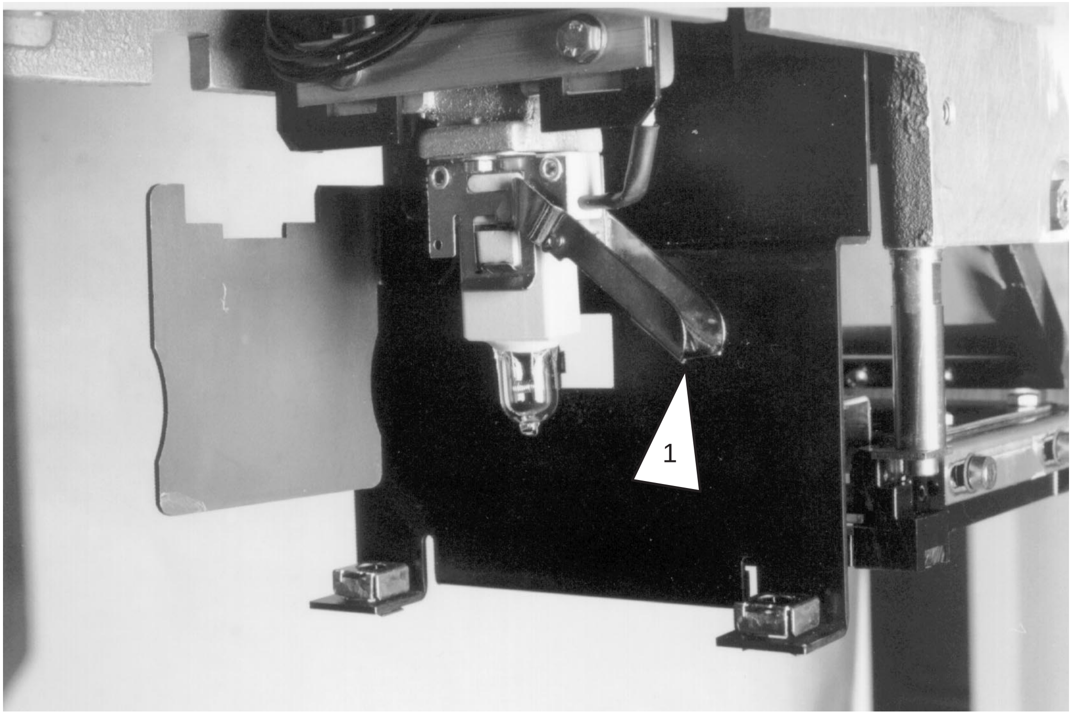


ILLUSTRATION 2
REMOVING THE CENTRING LIGHT BULB (shown with covers removed for clarity)



5.3 Fonctionnal check.

Check coincidence between light field and XRAY field (see CAL025).

DISASSEMBLY & RE-ASSEMBLY OF THE HALOGEN LAMP Job Card DR 014 4 of 4

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Senographe 700T and 800T — Job Card DR 015

Purpose: **DISASSEMBLY & RE-ASSEMBLY OF THE MIRROR ASSEMBLY**	Version No.: Date: Dec. 18, 1995
Time: 30 min	Personnel: 1 field engineer

SECTION 1
SUPPLIES

- Renewal part mirror assembly

SECTION 2
TOOLS

- Engineer's standard toolkit

SECTION 3
SPECIAL SAFETY PRECAUTIONS

CAUTION

The maximum temperature of the X–RAY Tube can reach 75°C – therefore, before removing the covers from the X–RAY Tube make sure it has cooled down sufficiently to no longer present a hazard.

- None, but see note concerning handling the mirror assembly.

SECTION 4
PRE-REQUISITES

- DR 011 must be done before you can start this procedure.
- Switch OFF the Senographe.
- Open the disconnector 300 S1.

SECTION 5
TASK DESCRIPTION

5.1 Removing the old mirror

1. Undo four screws and remove the light-shield enclosing the mirror and halogen light-bulb assembly (see arrow X in Illustration 1 for location).
2. Undo the nut on the mirror adjustment screw (arrow 2 in Illustration 1) and remove the nut and washer.
3. On each side of the assembly loosen the locking nut (arrow 1).
4. Undo the Allen screw in the centre of each nut and remove the mirror.

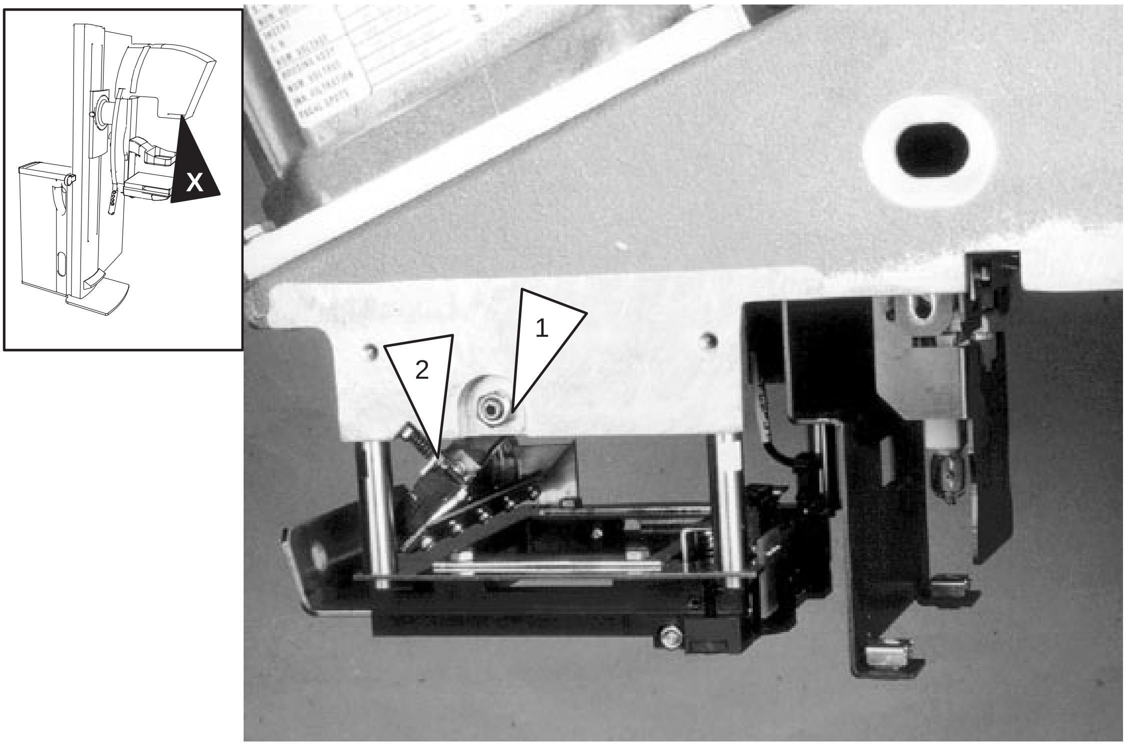
5.2 Installing the new mirror

CAUTION

The mirror surface is very fragile and must be kept scrupulously clean – you should therefore exercise extreme care when handling and positioning it, and in no circumstances wipe it with a finger.

Installation of the new mirror is the reverse order of the removal procedure.

ILLUSTRATION 1
LOCATION OF THE MIRROR ASSEMBLY MOUNTING SCREWS



5.3 Fonctionnal check.

Check coincidence between light field and XRAY field (see CAL025).

Senographe 700T and 800T Job Card DR 016

Purpose: **DISASSEMBLY & RE–ASSEMBLY OF THE COLLIMATOR DETECTION BOARD 200PL2**	Version No.: Date: Dec. 18, 1995
Time: 30 min	Personnel: 1 field engineer

SECTION 1
SUPPLIES

- Renewal part collimator detection board 200PL2.

SECTION 2
TOOLS

- Engineer’s standard toolkit

SECTION 3
SPECIAL SAFETY PRECAUTIONS

- None

SECTION 4
PRE-REQUISITES

- DR011 must be done before this procedure can be started.
- Switch OFF the Senographe.
- Open the disconnector 300 S1.

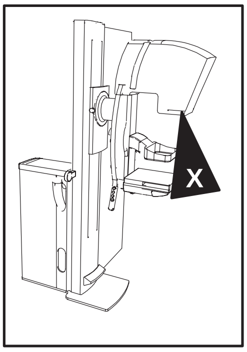
DISASSEMBLY & RE–ASSEMBLY OF THE COLLIMATOR DETECTION BOARD Job Card DR 016 2 of 2

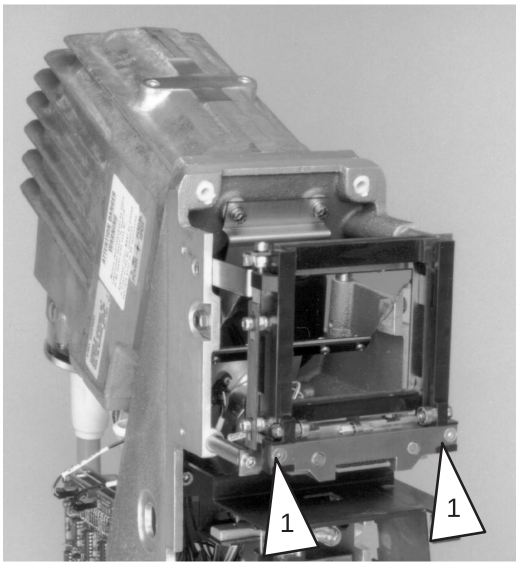
SECTION 5
TASK DESCRIPTION

5.1 Removing the old detection board

1. Undo four screws and remove the light-shield enclosing the mirror and halogen light-bulb assembly (see arrow X in Illustratrion 1 for location).
2. Undo the two screws (arrows 1 in Illustration 1) on the underside of the XRT head and remove the board.

ILLUSTRATION 1





5.2 Installing the new board

Installation is the reverse order of the removal procedure.

5.3 Fonctionnal check.

Check coincidence between light field and XRAY field (see CAL025).

DISASSEMBLY/
RE–ASSEMBLY

Senographe 700T and 800T Job Card DR 017

Purpose: **REMOVING & RE-INSTALLING THE EXAMINATION ARM COVERS**	Version No.: Date: Dec. 18, 1995
Time: 15 min	Personnel: 1 field engineer

SECTION 1
SUPPLIES

- None

SECTION 2
TOOLS

- Engineer's standard toolkit

SECTION 3
SPECIAL SAFETY PRECAUTIONS

- None

SECTION 4
PRE-REQUISITES

- DR011 must be done before you can start this procedure.

REMOVING & RE-INSTALLING THE EXAMINATION ARM COVERS

Job Card DR 017

SECTION 5
TASK DESCRIPTION

Note: Left-hand and right-hand sides are as seen from the examination arm (or the patient's) viewpoint.

5.1 Removing the covers (referring to Illustration 1)

1. At the location shown by arrow 1, remove the white blanking plugs, then undo two screws and remove the bottom cover of the arm to a safe place.
2. On the back of the arm in the area shown by arrows 2, remove the white blanking plugs, and remove the four screws.
3. On the right-hand side of the arm and opposite the arrow 3, remove the blanking cap and undo the screw securing the two halves of the arm cover.
4. At the point indicated by arrow 4, remove the Allen screw securing the handle to the arm.
5. Loosen a quarter of a turn the screw indicated by arrow 5 and then pivot the handle away from the arm enough to allow you to remove the left-hand side cover.
6. Repeat steps 4. & 5. for the right-hand handle and arm cover.
7. Undo the screw (arrow 6) and remove the the centre panel by lifting the top end up into the XRT support arm in front of the compression motor and then moving the bottom edge out from behind the compression paddle.

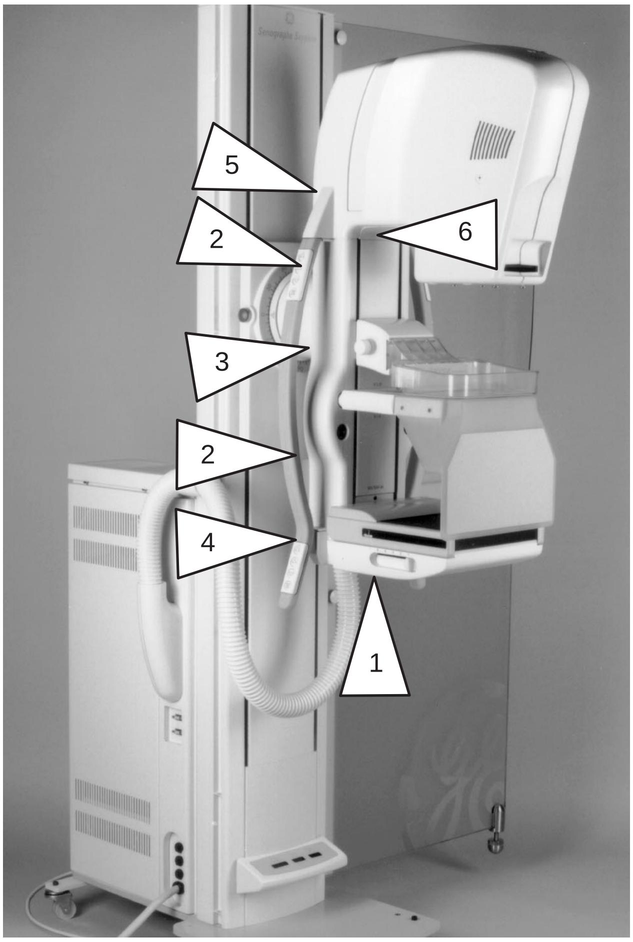
5.2 Re-installing the covers

Re-installing the covers is the reverse order of the removal procedure.

REMOVING & RE-INSTALLING THE EXAMINATION ARM COVERS

Job Card DR 017

ILLUSTRATION 1
LOCATION OF THE ARM SECURING SCREWS



REMOVING & RE-INSTALLING THE EXAMINATION ARM COVERS

Job Card DR 017

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Senographe 700T and 800T Job Card DR 018

Purpose: **DISASSEMBLY & RE-ASSEMBLY OF THE COMPRESSION MOTOR ASSEMBLY**	Version No.: Date: Dec. 18, 1995
Time: 35 min	Personnel: 1 field engineer

SECTION 1
SUPPLIES

- Renewal part compression motor assembly

SECTION 2
TOOLS

- Engineer’s standard toolkit

SECTION 3
SPECIAL SAFETY PRECAUTIONS

- None

SECTION 4
PREREQUISITES

- DR011 & DR017 must be done before you can start this procedure.
- Position the examination arm at about 90° and at a comfortable working height.
- Set the compression paddle to its lowest position.
- Switch OFF the Senographe.
- Open the disconnector 300 S1.

SECTION 5
TASK DESCRIPTION

5.1 Removing the old motor

1. Undo one screw at the top of the compression arm cover and remove the cover.
2. Undo the two screws (arrow 1 Illustration 1) and remove the metal clip positioning the belt in its clamp.
3. Switch on the AC power, re-positioning the compression arm if necessary.
4. To remove the belt-end from the clamp, lift the compression arm upwards slightly and slide the belt out sideways (keep it parallel to the clamp) – note that four teeth of the belt are held by the clamp.
5. Switch off the AC power.
6. Referring to Illustration 2 arrow 1 for location, remove the four screws securing the compression motor assembly.
7. Disconnect the cable W200 from the motor and remove the assembly.
8. Remove the belt from the motor drive-pulley.
9. Undo the four screws securing the motor to its mounting bracket and remove the motor.

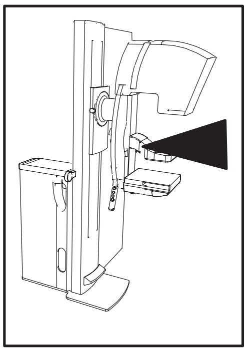
5.2 Installing the new motor

Installation of the new motor is the reverse order of the removal procedure.

DISASSEMBLY & RE-ASSEMBLY OF THE COMPRESSION MOTOR ASSEMBLY

Job Card DR 018 3 of 4

ILLUSTRATION 1
BELT SECURING POINT



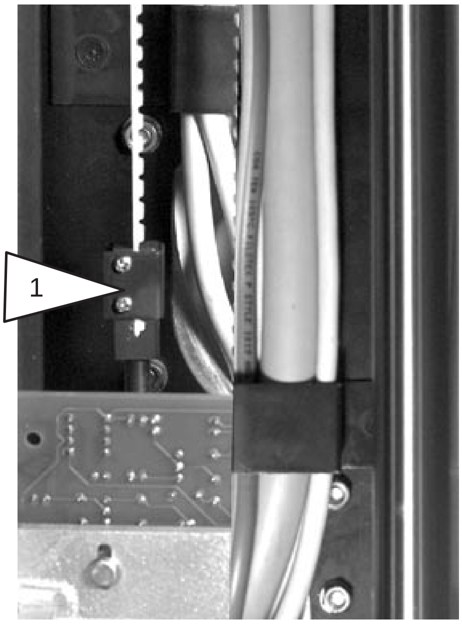
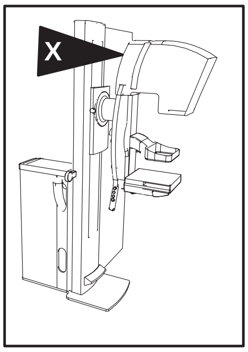
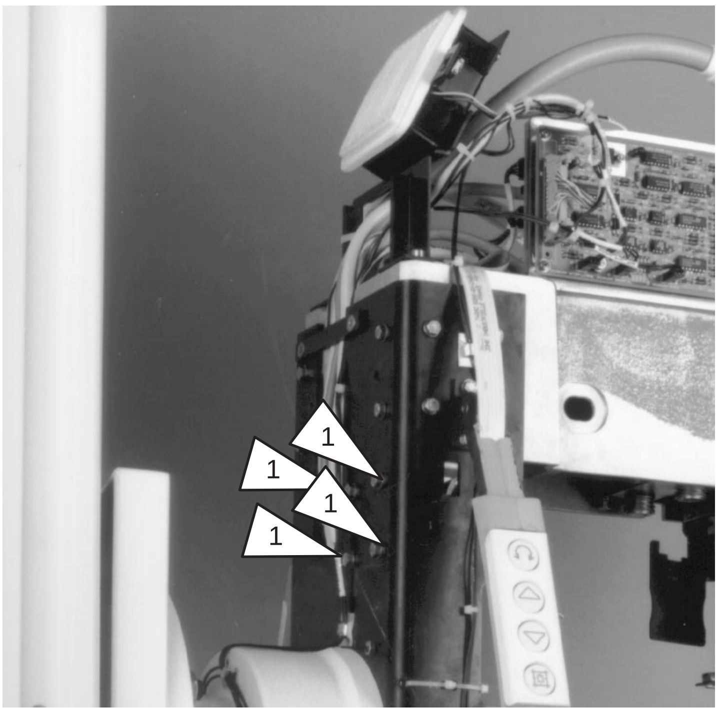


ILLUSTRATION 2
LOCATION OF THE COMPRESSION MOTOR SECURING SCREWS

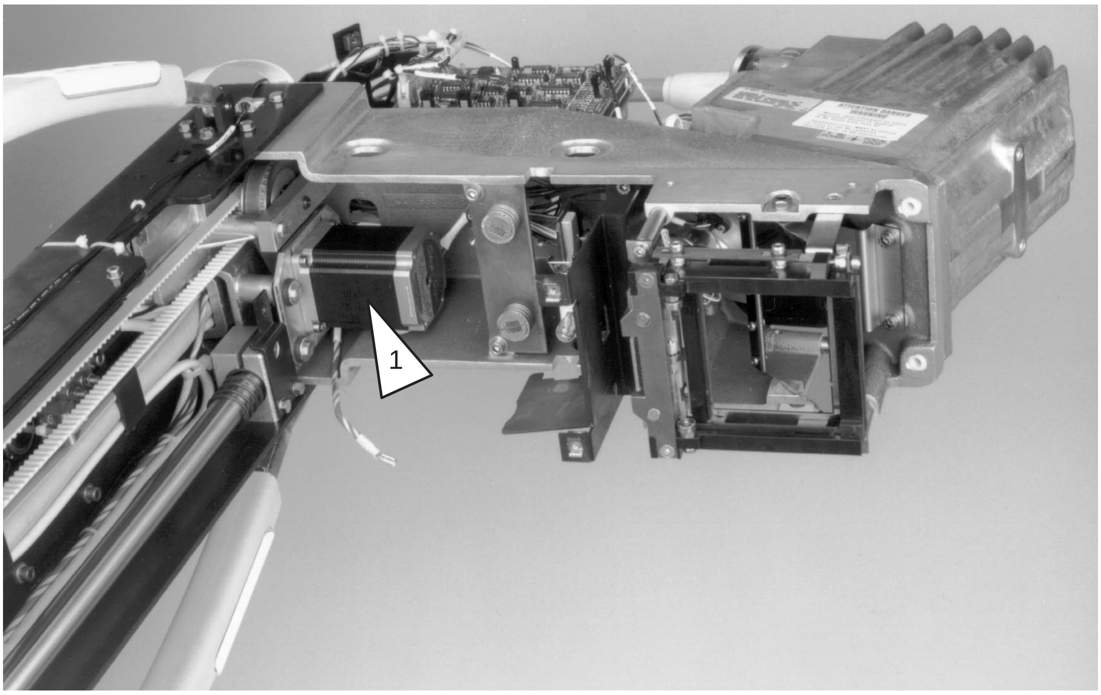




DISASSEMBLY & RE-ASSEMBLY OF THE
COMPRESSION MOTOR ASSEMBLY

Job Card DR 018

ILLUSTRATION 3
LOCATION OFTHE COMPRESSION MOTOR



Senographe 700T and 800T Job Card DR 019

Purpose: **DISASSEMBLY & RE-ASSEMBLY OF THE COMPRESSION DRIVE-BELT**	Version No.: Date: Dec. 18, 1995
Time: 45 min	Personnel: 1 field engineer

SECTION 1
SUPPLIES

- Renewal part drive-belt

SECTION 2
TOOLS

- Engineer’s standard toolkit

SECTION 3
SPECIAL SAFETY PRECAUTIONS

- None

SECTION 4
PRE-REQUISITES

- DR 011 & DR 017 must be done before you can start this procedure.
- Switch OFF the Senographe.
- Open the disconnector 300 S1.

DISASSEMBLY & RE-ASSEMBLY OF THE COMPRESSION DRIVE-BELT — Job Card DR 019 — 2 of 2

SECTION 5
TASK DESCRIPTION

5.1 Removing the old belt (referring to Ilustration 1)

1. Undo the two screws (arrow 1) and remove the metal clip positioning the belt-end in its clamp.

Note: When releasing the belt-ends, do not withdraw the belt from the pulleys.

2. To remove the belt-end from the clamp, slide it out sideways (keep it parallel to the clamp) – note that four teeth of the belt are inserted in the clamp.
3. Repeat steps 1. & 2. for the other end (arrow 2) of the belt.

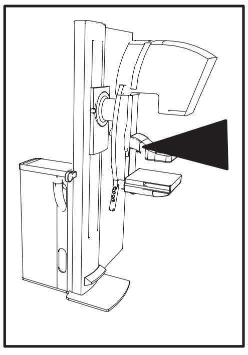
5.2 Installing the new belt

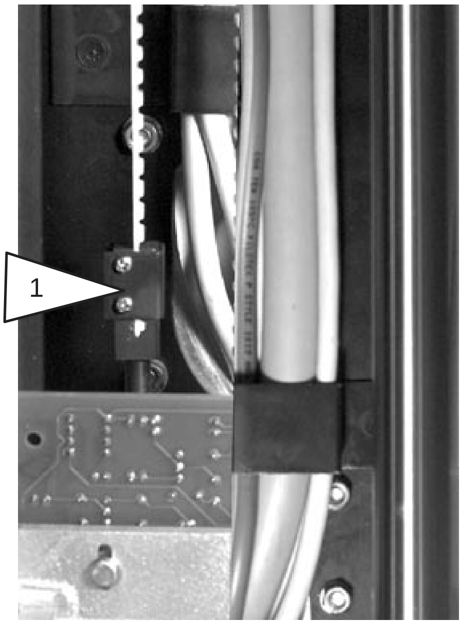
1. To make the job of threading the new belt round the pulleys very much easier, use adhesive tape to attach one end of the new belt to one end of the old one (so the belt can pass through the narrow gap behind the pulleys, the belts must be attached by butting - not overlapping - the ends together).
2. Slide the belt-ends into their clamps and secure them with the metal clips and screws.

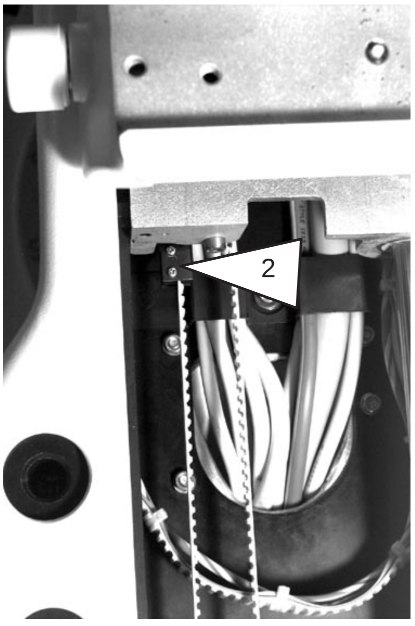
5.3 Adjustment

Perform Section 5.3 of DR 020, and then Job Card CAL 009.

ILLUSTRATION 1
LOCATION OF BELT CLAMPS







DISASSEMBLY/ RE–ASSEMBLY

Senographe 800T (Not 700T) Job Card DR 020

Purpose: **DISASSEMBLY & RE-ASSEMBLY OF THE THICKNESS POTENTIOMETER ASSEMBLY**	Version No.: Date: Dec. 18, 1995
Time: 30 min	Personnel: 1 field engineer

SECTION 1
SUPPLIES

- Renewal part potentiometer

SECTION 2
TOOLS

- Engineer's standard toolkit

SECTION 3
SPECIAL SAFETY PRECAUTIONS

- None

SECTION 4
PREREQUISITES

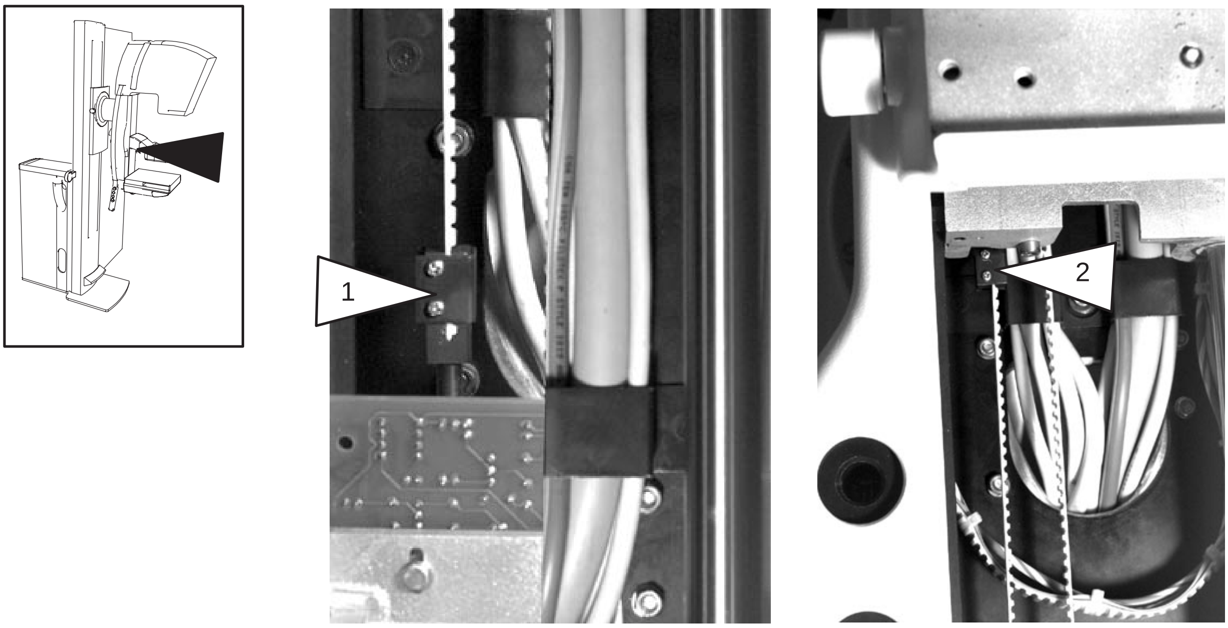
- DR011 & DR017 must be done before you can start this procedure.
- Position the examination arm at about 90° and at a comfortable working height.
- Set the compression paddle to about mid-position.
- Switch OFF the Senographe.
- Open the disconnector 300 S1.

SECTION 5
TASK DESCRIPTION

5.1 Removing the old potentiometer

1. Undo the two screws (arrow 1 in Illustration 1) and remove the metal clip positioning the belt in its clamp.
2. Slide the belt sideways out of the clamp.

ILLUSTRATION 1
LOCATION OF THE BELT SECURING CLAMPS



3. Disconnect the potentiometer cable W209 from JP203.

CAUTION

The proper positioning of the Bucky connector plate is critical to plug life – if you move it you must re-position by doing Job Card CAL 021.

4. Undo the nut (arrow 1 in Illustration 2) securing the potentiometer mounting bracket, unclip the tensioning spring and remove the potentiometer.
5. Undo the Allen screw on the potentiometer drive-pinion and remove the pinion.
6. Undo the nut and remove the potentiometer from its mounting bracket.

DISASSEMBLY & RE-ASSEMBLY OF THE THICKNESS POTENTIOMETER ASSEMBLY Job Card DR 020

ILLUSTRATION 2
LOCATION OF THE THICKNESS POTENTIOMETER

5.2 Installing the new potentiometer

1. Before installing the potentiometer, set it to its approximate mechanical mid-position.
2. When re-installing the potentiometer bracket securing nut, apply screw locking compound to the screw-thread and tighten the nut just enough so that the bracket is still free to move.

From this point onwards, installing the new potentiometer is the reverse order of the removal procedure.

5.3 Adjusting the potentiometer position

1. Locate the 200PL9Arm2 Distribution Board (arrow X in the insert of Illustration 2).
2. Connect a Digital Meter between TP1 (ground) and TP3.
3. Set the compression carriageto its mechanical up–position, the resistance reading should be $25\Omega \pm 1$ (with the spring compressed).
4. If the reading is not within limits, re-adjust the mechanical position of the potentiometer shaft by pulling the potentiometer away from the drive-pinion and turning the shaft with a small screwdriver.

5.4 Functional check

Calibrate the potentiometer position by performing Job Card CAL 009.

DISASSEMBLY & RE-ASSEMBLY OF THE THICKNESS POTENTIOMETER ASSEMBLY Job Card DR 020

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Senographe 700T and 800T Job Card DR 021

Purpose: **DISASSEMBLY & RE-ASSEMBLY OF THE COMPRESSION SENSOR BOARD 200PL7**	Version No.: Date: Dec. 18, 1995
Time: 30 mins + calibration time	Personnel: 1 field engineer

SECTION 1
SUPPLIES

- Renewal part compression board 200PL7.

SECTION 2
TOOLS

- Engineer's standard toolkit

SECTION 3
SPECIAL SAFETY PRECAUTIONS

- None

SECTION 4
PREREQUISITES

- DR 011 & DR 017 must be done before you can start this procedure.
- Position the examination arm at a comfortable working height.
- Set the compression paddle to about its highest position.
- Position the arm at 90 that the compression paddle does not move when you switch OFF the Senographe.
- Switch OFF the Senographe.
- Open the disconnector 300 S1.

SECTION 5
TASK DESCRIPTION

5.1 Removing the old board

1. Remove the plastic compression paddle to a safe place.
2. Remove the screw (arrow 1) and the plate protecting the cables to the compression arm.
3. Insert a flat-bladed screwdriver in the holes (arrows 2 in Illustration 1) and turn the threaded pillars until they fall out of their threaded holes and drop onto the underside cover.
4. On the underside of the compression arm (see arrow 3) use a very fine screwdriver blade to gently prise away the bottom cover (retrieve the two pillars you loosened in step 3.).
5. Insert a 4mm Allen key in the two holes shown by arrows 4 and remove the two screws.
6. Support the compression arm as you undo the two screws in the positions shown by arrows 6 – when free, place the compression arm to one side.
7. Unplug the two cables W212 & W213 from the compression board.
8. Undo three screws and remove the board (arrow 7).

5.2 Installing the new board

Installation of the new board is the reverse order of the removal procedure, except that you should screw in the two threaded pillars (to within about 2mm of the casing) before re-installing the compression arm.

5.3 Functional check

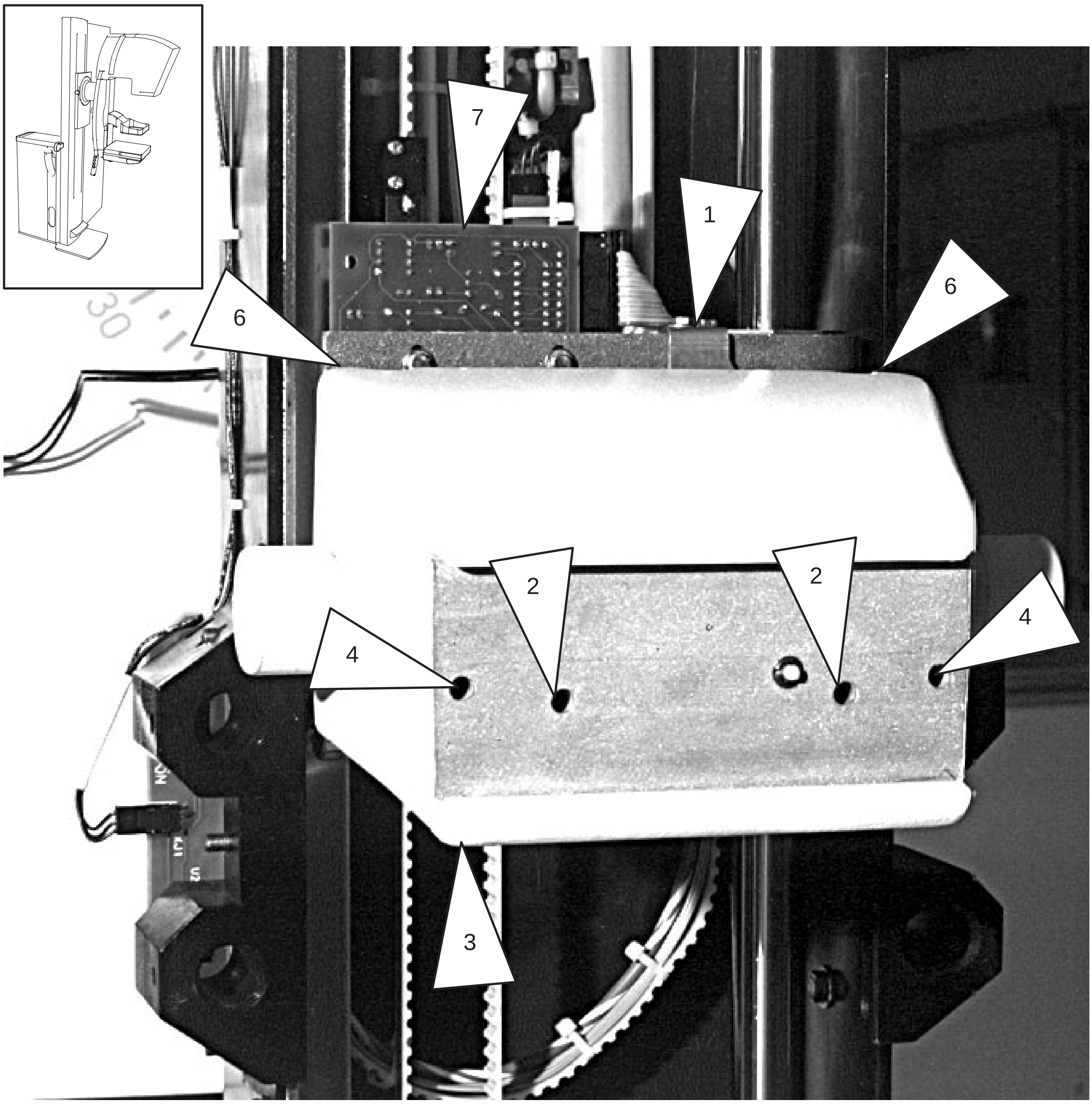
To calibrate the compression board, perform the following Job Cards:

- CAL 019
- CAL 020
- CAL 009

DISASSEMBLY & RE-ASSEMBLY OF THE COMPRESSION SENSOR BOARD 200PL7

Job Card DR 021

ILLUSTRATION 1
LOCATION OF THE COMPRESSION BOARD AND THE ARM SECURING SCREWS



DISASSEMBLY & RE-ASSEMBLY OF THE COMPRESSION SENSOR BOARD 200PL7	Job Card DR 021	4 of 4

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Senographe 700T and 800T Job Card DR 022

Purpose: **DISASSEMBLY & RE-ASSEMBLY OF THE ENCODER BOARD & DISC ASSEMBLY**	Version No.: Date: Dec. 18, 1995
Time: 45 min	Personnel: 1 field engineer

SECTION 1
SUPPLIES

- Renewal part encoder board and wheel assembly

SECTION 2
TOOLS

- Engineer's standard toolkit

SECTION 3
SPECIAL SAFETY PRECAUTIONS

- None

SECTION 4
PREREQUISITES

- DR 011 & DR 017 must be done before you can start this procedure.
- Set the compression paddle to about its highest compression position.
- Rotate the examination arm at 180° and then position it so that it is at a comfortable working height.
- Switch OFF the Senographe.
- Open the disconnector 300 S1.

DISASSEMBLY & RE-ASSEMBLY OF THE ENCODER BOARD & DISC ASSEMBLY Job Card DR 022 2 of 4

SECTION 5
TASK DESCRIPTION

5.1 Removing the old board and encoder wheel

1. Remove the plastic compression paddle.
2. Insert a flat-bladed screwdriver in the holes (arrows 1 in Illustration 1) and turn the threaded pillars until they fall out of their threaded holes and drop onto the underside cover.
3. On the underside of the compression arm (see arrow 2 in Illustration 1) use a very fine screwdriver blade to gently prise the bottom cover up and off.
4. Retrieve the two pillars from inside the compression arm casting.
5. Disconnect the ground cable W225 and the encoder board cable W212.
6. Undo the Allen screw (arrow 1 in Illustration 2) on both knobs just enough to allow the knob to turn completely around the shaft (the clearance of the hole is quite small).
7. Remove the knobs sideways through the casing.
8. Undo four screws and remove the board and the encoder components.
9. Undo two screws and remove the optical sensor (note the spacers under the sensor).

ILLUSTRATION 1
LOCATION OF THE COMPRESSION ARM SECURING SCREWS

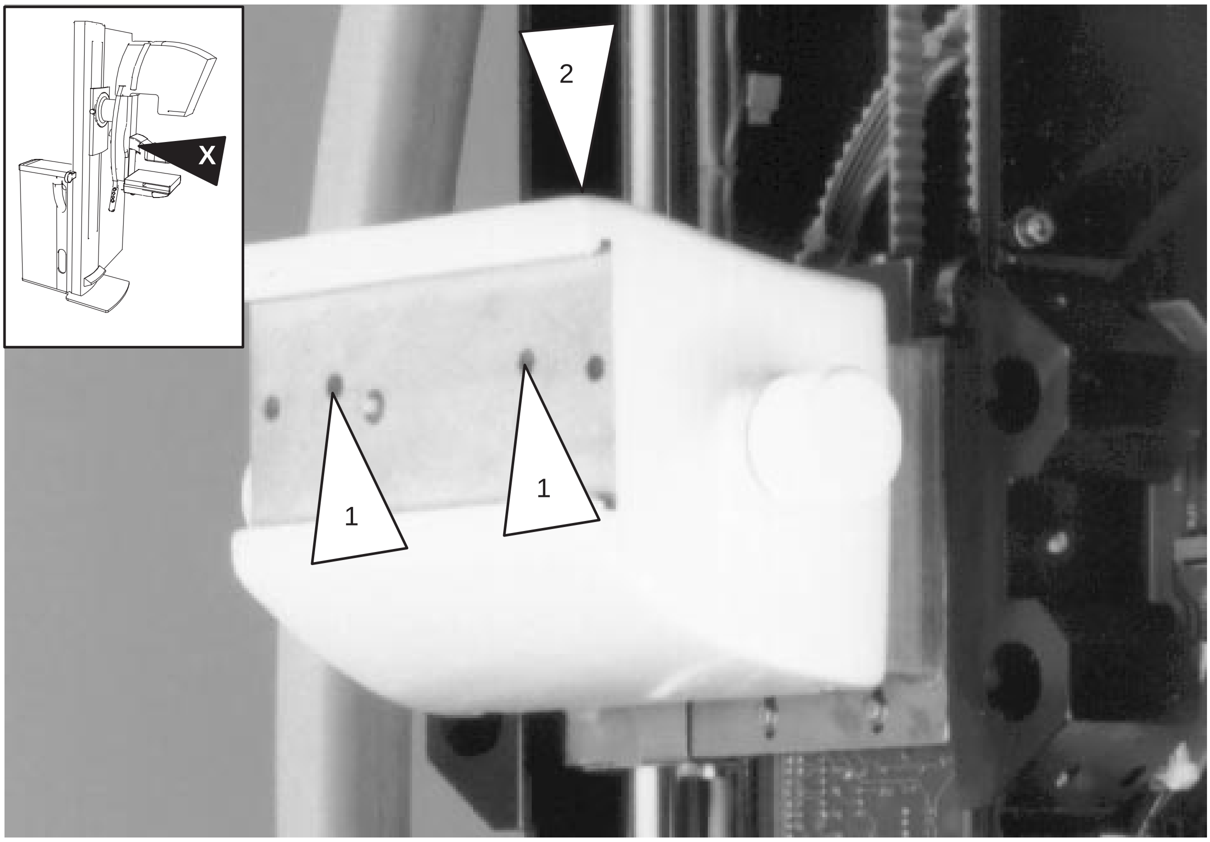
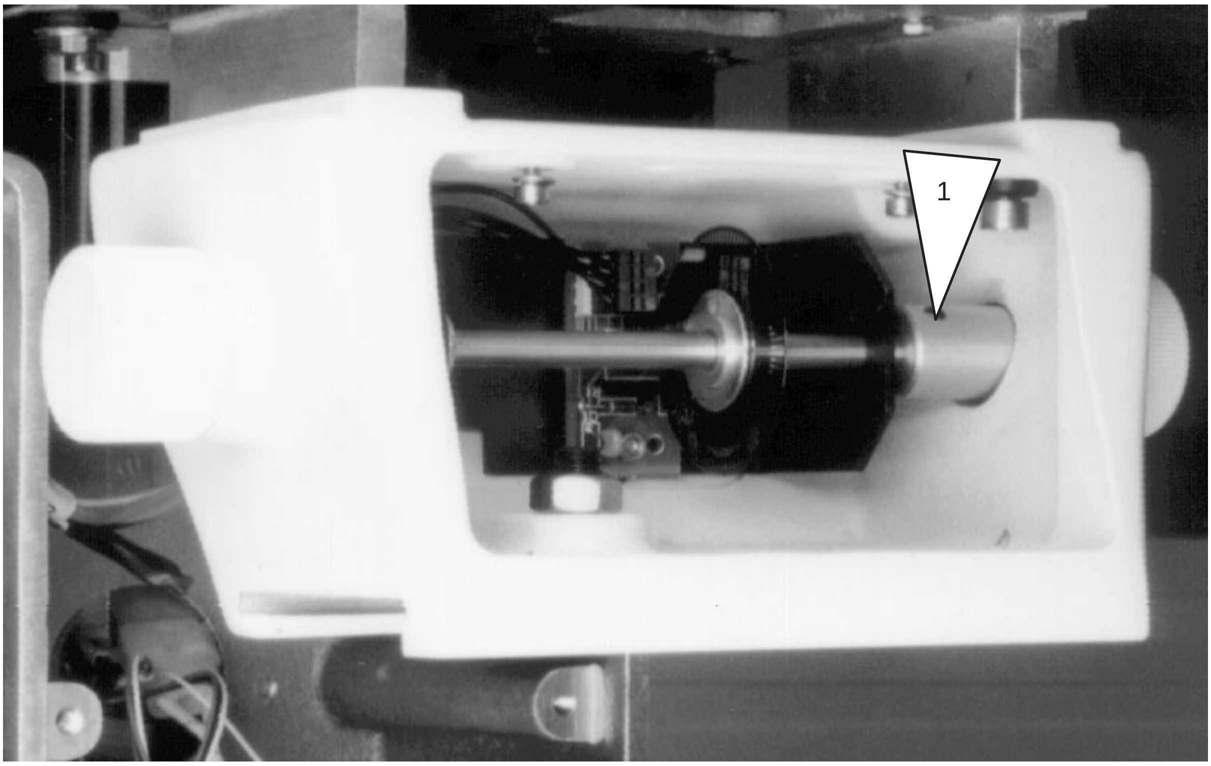


ILLUSTRATION 2
LOCATION OF THE ENCODER AND ENCODING DISC



5.2 Installing the new encoder board and disc

Installation is the reverse order of the removal procedure.

5.3 Functional check

Re-apply power to the Senographe and verify that turning either knob on the compression arm causes movement in the correct direction.

DISASSEMBLY & RE-ASSEMBLY OF THE ENCODER BOARD & DISC ASSEMBLY

Job Card DR 022

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Senographe 700T and 800T Job Card DR 023

Purpose: **DISASSEMBLY & RE-ASSEMBLY OF THE MAGNIFICATION BOARD 200PL6**	Version No.: Date: Dec. 18, 1995
Time: 30 min	Personnel: 1 field engineer

SECTION 1
SUPPLIES

- Renewal part magnification board

SECTION 2
TOOLS

- Engineer's standard toolkit

SECTION 3
SPECIAL SAFETY PRECAUTIONS

- None

SECTION 4
PREREQUISITES

- DR 011 & DR 017 must be done before you can start this procedure.
- Position the Examination arm so that it is at a comfortable working height.
- Switch off the Senographe.
- Open the disconnector 300 S1

DISASSEMBLY & RE-ASSEMBLY OF THE MAGNIFICATION BOARD 200PL6 Job Card DR 023

SECTION 5
TASK DESCRIPTION

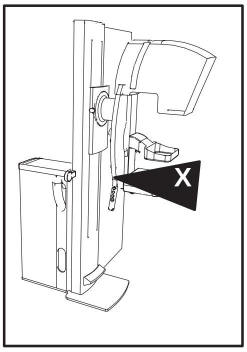
5.1 Removing the old board

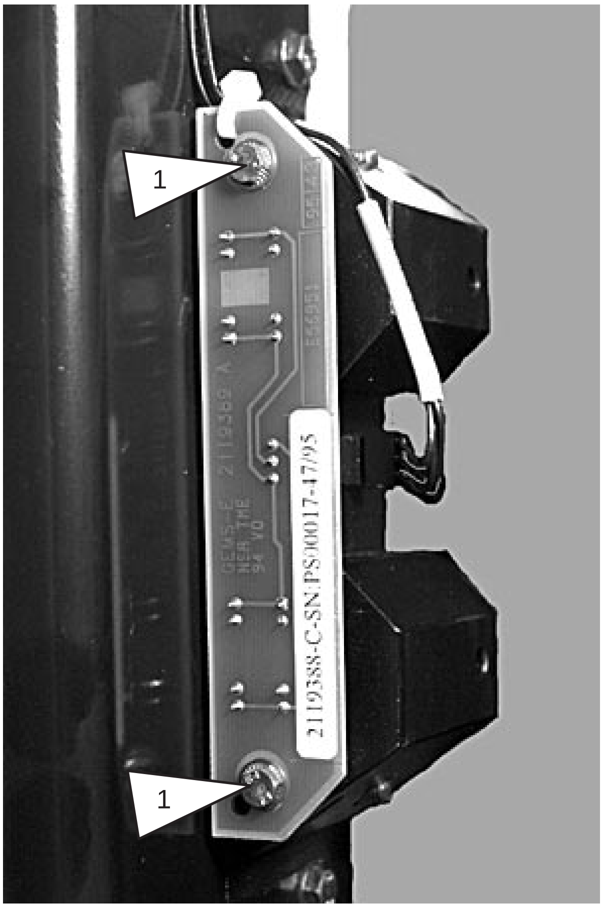
1. Referring to arrow X in the insert of Illustration 1 for location, disconnect the cable W218 from the board.
2. Undo the two screws (arrow 1) and remove the board.

5.2 Installing the new board

Installation of the new board is the reverse order of the removal procedure.

ILLUSTRATION 1





Senographe 700T and 800T	Job Card DR 024	1 of 4

Purpose: **DISASSEMBLY & RE-ASSEMBLY OF THE BUCKY GRID**	Version No.: Date: Dec. 18, 1995
Time: 0 h 30 min	Personnel: 1 field engineer

SECTION 1
SUPPLIES

- Renewal part Bucky grid

SECTION 2
TOOLS

- Engineer's standard toolkit

SECTION 3
SPECIAL SAFETY PRECAUTIONS

- None

SECTION 4
PREREQUISITES

- None

DISASSEMBLY & RE-ASSEMBLY OF THE BUCKY GRID

Job Card DR 024

SECTION 5
TASK DESCRIPTION

5.1 Removing the Bucky grid

1. Remove the Bucky from the Senographe and place it on a clean surface.
2. Referring to Illustration 1 for location, undo two screws and slide the cover backwards to remove it.
3. Referring to Illustration 2, remove the five screws (arrows X) securing one of the side mouldings (note that the two screws marked Xs are shorter than the others).
4. Gently lever the side moulding (arrow 1) away from the body of the Bucky (it may well be stiff).
5. Through the slots (arrows Y) in the bottom of the Bucky, remove the three (five on the larger Bucky) screws securing the grid (arrow 2).
6. Slide the grid out via the side the moulding was removed from in step 4..

5.2 Installing the new grid

Installation of the new grid is the reverse order of the removal procedure.

DISASSEMBLY & RE-ASSEMBLY OF THE BUCKY GRID Job Card DR 024 3 of 4

ILLUSTRATION 1
LOCATION OF TOP COVER SECURING SCREWS

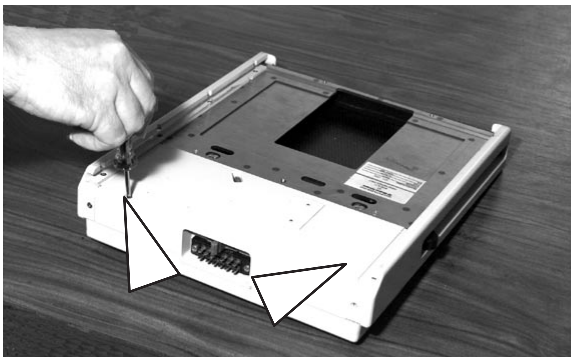
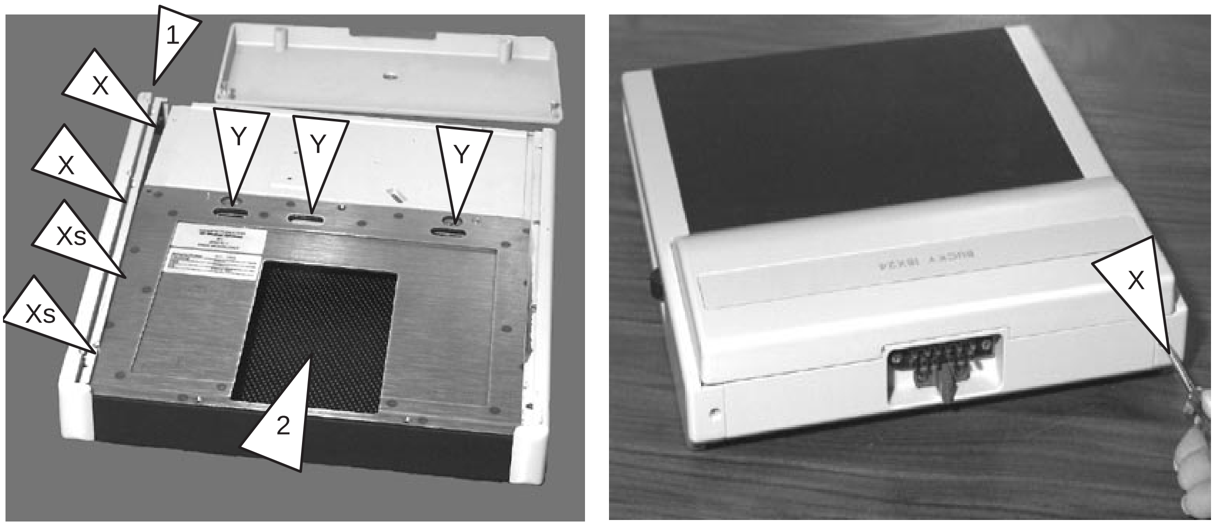


ILLUSTRATION 2
LOCATION OF SCREWS ON THE BASEPLATE



DISASSEMBLY & RE-ASSEMBLY OF THE BUCKY GRID	Job Card DR 024	4 of 4

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Senographe 700T and 800T — Job Card DR 025

Purpose: **RENEWING THE CABLES BETWEEN THE ARM AND THE ELECTRONICS CABINET**	Version No.: Date: Dec. 18, 1995
Time: x h xx min	Personnel: 1 field engineer

SECTION 1
SUPPLIES

- Renewal part cable assembly

SECTION 2
TOOLS

- Engineer’s standard toolkit

SECTION 3
SPECIAL SAFETY PRECAUTIONS

- None

SECTION 4
PRE-REQUISITES

- Remove the AC power from the Senographe before starting this procedure.

RENEWING THE CABLES BETWEEN THE ARM AND THE ELECTRONICS CABINET Job Card DR 025

SECTION 5
TASK DESCRIPTION

Refer to the Schematics manual for the Schematic 2122184SCH which also shows all the cable reference numbers and connections concerned in this procedure.

1. The connections between the electronics cabinet and the arm are as follows:

Cable no.	Cabinet connection	Arm connection
W100	J6 on 300–PL1	JP 200 (compression motor)
W101	J8 on 300–PL5	J4 200–PL5 (image receptor)
W102	J9 on 300–PL5	J1 200–PL3 (command board)
W103	J6 on 300–PL5	J1 200–PL9 (distribution board 2)
W104	J7 on 300–PL5	J1 200–PL1 (distribution board 1)
W105	J4 on 300–PL2	JP 202 200–L1 (light-centring)
W106	J2 on 300–PL2	JP 201 200–Y2 (angulation brake)
W107	grounding termination stud	TP200 (grounding stud)
W108	HV tank	XRT (HV cable)
W109	ground terminal on HV tank	+HT (XRT +HT connector)
W110	XJ2 on 300–PL12	Anode starter connection on XRT

2. When replacing a cable, make sure you route and cable-tie the new cable in exactly the same way as the old one.

Senographe 700T and 800T Job Card DR 026

Purpose: **DISASSEMBLY & RE-ASSEMBLY OF A HANDLE**	Version No.: Date: Dec. 18, 1995
Time:	Personnel: 1 field engineer

SECTION 1
SUPPLIES

- Renewal part handle assembly

SECTION 2
TOOLS

- Engineer's standard toolkit

SECTION 3
SPECIAL SAFETY PRECAUTIONS

- None

SECTION 4
PRE-REQUISITES

- Switch off the AC pwer to the Senographe before starting this procedure.
- DR011 & DR017 must be done before this procedure can be started.

DISASSEMBLY & RE-ASSEMBLY OF A HANDLE

Job Card DR 026

SECTION 5
TASK DESCRIPTION

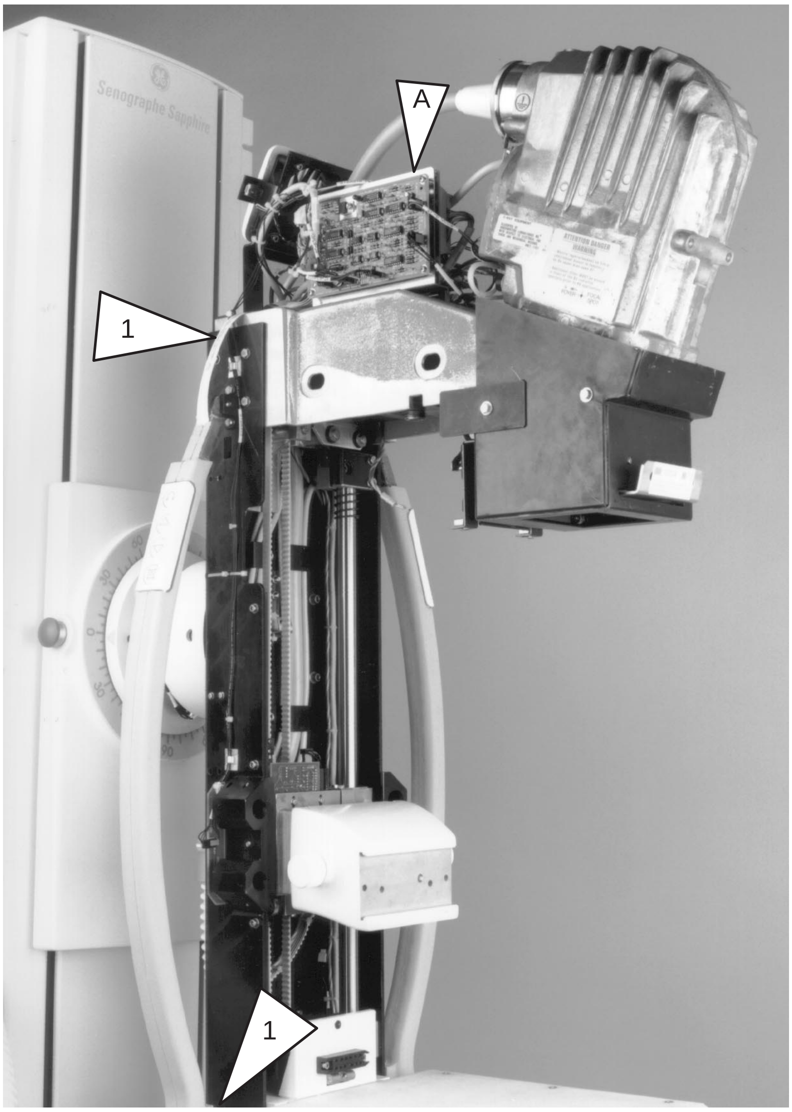
5.1 Removing the handle (referring to Illustration 1)

1. In the area shown by arrow A, locate the board 200–PL1 and disconnect the cable W230 from J11 or J12 (depending on which handle you are replacing).
2. In the areas shown by arrows 1, undo two screws and remove the handle assembly.

5.2 Re-installing the handle (referring to Illustration 1)

Re-installing the handle is the reverse order of the removal procedure.

ILLUSTRATION 1
THE HANDLE SECURING POINTS



Senographe 700T and 800T	Job Card DR 027	1 of 4

Purpose: **BOARD CALIBRATION**	Version No.: Date: Dec. 18, 1995
Time: x h xx min	Personnel: 1 field engineer

SECTION 1
SUPPLIES

- None

SECTION 2
TOOLS

- Engineer's standard toolkit

SECTION 3
SPECIAL SAFETY PRECAUTIONS

- None

SECTION 4
PRE-REQUISITES

- None

BOARD CALIBRATION

Job Card DR 027

SECTION 5
TASK DESCRIPTION

When any of the following boards is changed, the new board must be calibrated by performing the indicated calibration procedures.

Board description	Reference designator	Job Cards to be done
200 PL5 HTPM	200–PL5	DR032
200 PL9 Arm 2 distribution	200–PL9	CAL 008 & CAL 009
300 PL1 Elevator & compression	300–PL1	CAL 020
300 PL6 Auxiliaries control	300–PL6	CAL 001 & CAL 002
300 PL7 Low voltage psu	300–PL7	CAL 024
300 PL8 High voltage control	300–PL8	CAL 016 & CAL 017
300 PL11 Auxiliary power	300–PL11	CAL 001 & CAL 002

Note: When you change a board neither listed above, nor the subject of a job card procedure, there is no need for any recalibration.

BOARD CALIBRATION

Job Card DR 027

BOARD CALIBRATION

Job Card DR 027 4 of 4

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Senographe 700T and 800T Job Card DR 028

Purpose: **DISASSEMBLY & RE-ASSEMBLY OF THE PROTECTIVE GLASS**	Version No.: Date: Dec. 18, 1995
Time: 30 min	Personnel: 1 FE + an assistant

SECTION 1
SUPPLIES

Renewal part leaded glass

SECTION 2
TOOLS

- Engineer's standard toolkit
- A block of material (for example, a block of wood) having one dimension of 60 ± 1mm and the other two (non-critical) dimensions a minimum of approximately 50mm and 200mm.

SECTION 3
SPECIAL SAFETY PRECAUTIONS

CAUTION

The glass weighs 40Kg and should, therefore, be handled with care.

SECTION 4
PREREQUISITES

None

DISASSEMBLY & RE-ASSEMBLY OF THE PROTECTIVE GLASS Job Card DR 028

SECTION 5
TASK DESCRIPTION

5.1 Removing the glass

1. Place the block of material under the glass and close to the Senographe column.

Note: If the floor covering is a flexible material, then the thickness of the block of material will need to be increased until the block is supporting the glass.

2. Remove the control unit from its bracket on the glass and place it safely on top of the electronics cabinet.
3. Undo the two screws securing the control unit bracket and remove the bracket and screws.
4. Loosen (do not remove) the four screw heads until they are clear of their retaining recesses.
5. Carefully slide the glass along the length of the block away from the mounting bracket and remove it.

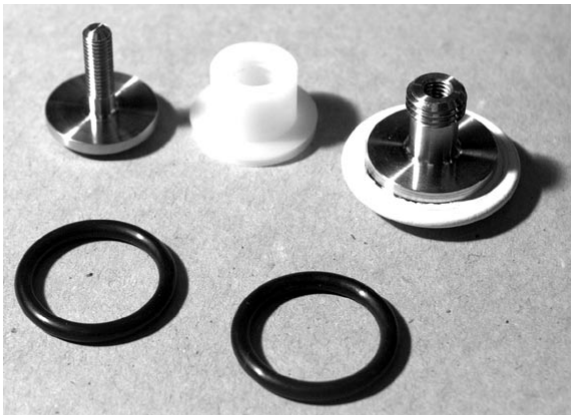
5.2 Re-installing the glass

Note: Clearly, steps 1. & 2. need to be done only when you install a new glass.

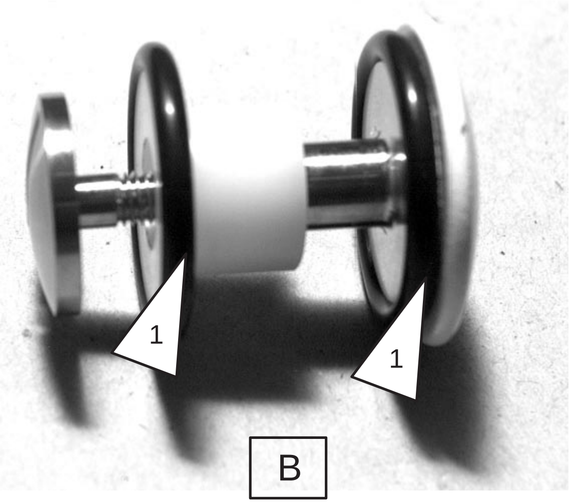
1. Place the new glass on a suitable flat surface at a convenient working height.
2. Referring to Illustration 1 for details, assemble the four mounting screw assemblies (A) as shown at B in the holes at the edge of the glass (the other two are for the control unit).
3. Place the glass on the block of material and slide it carefully up to the mounting bracket on the column.
4. Position the glass so that you can slide the screws into their securing holes (arrow 1 in Illustration 2).
5. Making sure the black gaskets (see arrows 1 in Illustration 1) remain in place, tighten the four screws securely.
6. Position the supporting foot (arrow 2 in Illustration 2) with the shaped gaskets between the glass and the foot, and the shaped metal piece between the Allen screws and the gasket.
7. Remove the block of material and adjust the height of the foot until it is just supporting the weight of the glass, then tighten the Allen screw on the moveable part of the foot.
8. Place the two remaining screw assemblies in the holes in the middle of the glass (arrow 3 in Illustration 2) and mount the control unit bracket.

DISASSEMBLY & RE-ASSEMBLY OF THE PRO-TECTIVE GLASS Job Card DR 028 3 of 4

ILLUSTRATION 1
GLASS MOUNTING SCREW ASSEMBLY

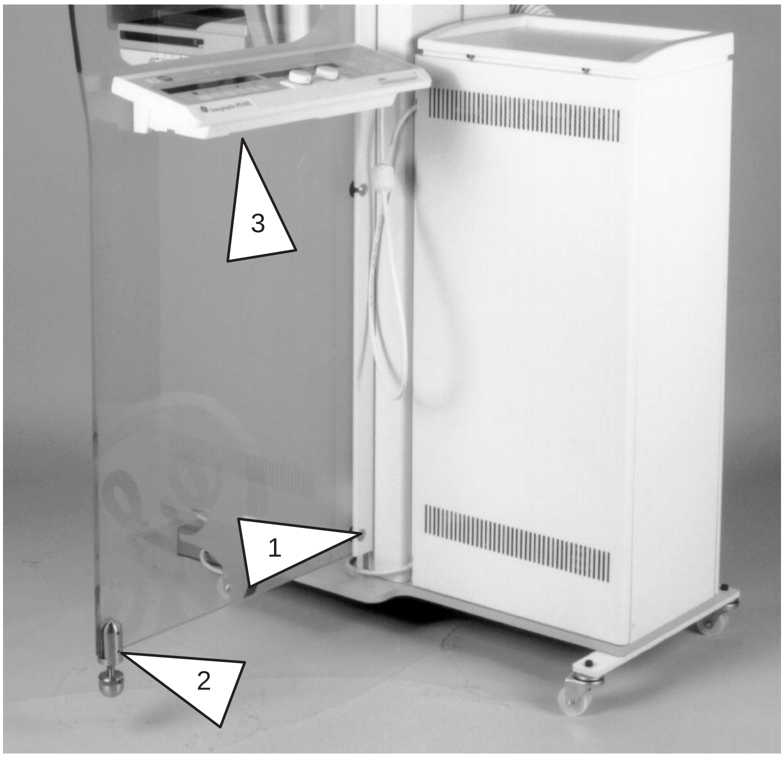


A



B

ILLUSTRATION 2
LOCATION OF SECURING PARTS ON THE GLASS



DISASSEMBLY/
RE–ASSEMBLY

DISASSEMBLY & RE-ASSEMBLY OF THE PROTECTIVE GLASS Job Card DR 028

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Senographe 700T and 800T Job Card DR 029

Purpose: **DISASSEMBLY & RE-ASSEMBLY OF THE LED DISPLAY PANEL (800T ONLY)**	Version No.: Date: Dec. 18, 1995
Time: 30 min	Personnel: 1 field engineer

SECTION 1
SUPPLIES

Renewal part LED display

SECTION 2
TOOLS

Engineer’s standard toolkit

SECTION 3
SPECIAL SAFETY PRECAUTIONS

None

SECTION 4
PRE-REQUISITES

- DR005 must be done before this procedure can be started.
- Switch off the AC power to the Senographe before starting this procedure.

DISASSEMBLY & RE-ASSEMBLY OF THE LED DISPLAY PANEL Job Card DR 029

SECTION 5
TASK DESCRIPTION

5.1 Removing the LED panel

1. Undo two screws on the rear of the lower front column cover and remove the LED display panel.

5.2 Installing the new LED panel

Installing the new display is the reverse order of the removal procedure, followed by DR005 re-installation procedure.

Senographe 700T and 800T Job Card DR 030

Purpose: **DISASSEMBLY & RE-ASSEMBLY OF THE 300PL9 PSU BOARD, DIODE BRIDGE & RESISTOR 100R**	Version No.: Date: Dec. 18, 1995
Time: 1 hr	Personnel: 1 field engineer

SECTION 1
SUPPLIES

- Renewal part psu board, diode bridge, 100R resistor (high power)
- If the resistor or diode bridge is to be changed, a supply of heatsink compound

SECTION 2
TOOLS

- Engineer's standard toolkit

SECTION 3
SPECIAL SAFETY PRECAUTIONS

- None

SECTION 4
PRE-REQUISITES

- DR001 must be done before you can start this procedure.
- Switch off power to Senographe before starting this procedure.

DISASSEMBLY & RE-ASSEMBLY OF THE 300PL9 PSU BOARD, DIODE BRIDGE & RESISTOR 100R

Job Card DR 030

SECTION 5
TASK DESCRIPTION

5.1 Removing the psu board (referring to Illustration 1 arrow X for location)

1. Disconnect the 13 cables from the psu board.
2. Remove five Allen screws (arrows Z) securing the pcb to the chassis.
3. Remove two screws (arrows Y) securing the pcb to the chassis mounted resistor.
4. Remove six screws (arrows W) securing the pcb to the diode bridge assembly.
5. Remove the pcb.

5.2 Re-installing the psu board

Re-installation is the reverse order of the removal procedure.

5.3 Removing the diode bridge

1. Follow steps 1 through 5 of Section 5.1
2. Undo the screws securing the diode bridge to the chassis and remove the assembly.

5.4 Installing the new diode bridge

1. Installation is the reverse order of the removal procedure, except that you should apply heatsink compound to the contact surface of the assembly before screwing it onto the chassis.
2. Re-install the psu board.

5.5 Removing the 100R resistor

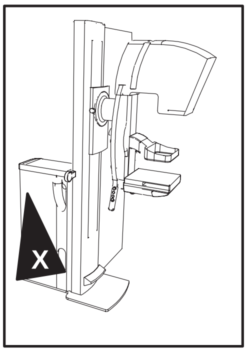
1. Follow steps 1 through 5 of Section 5.1
2. Undo the screws securing the resistor to the chassis and remove the assembly.

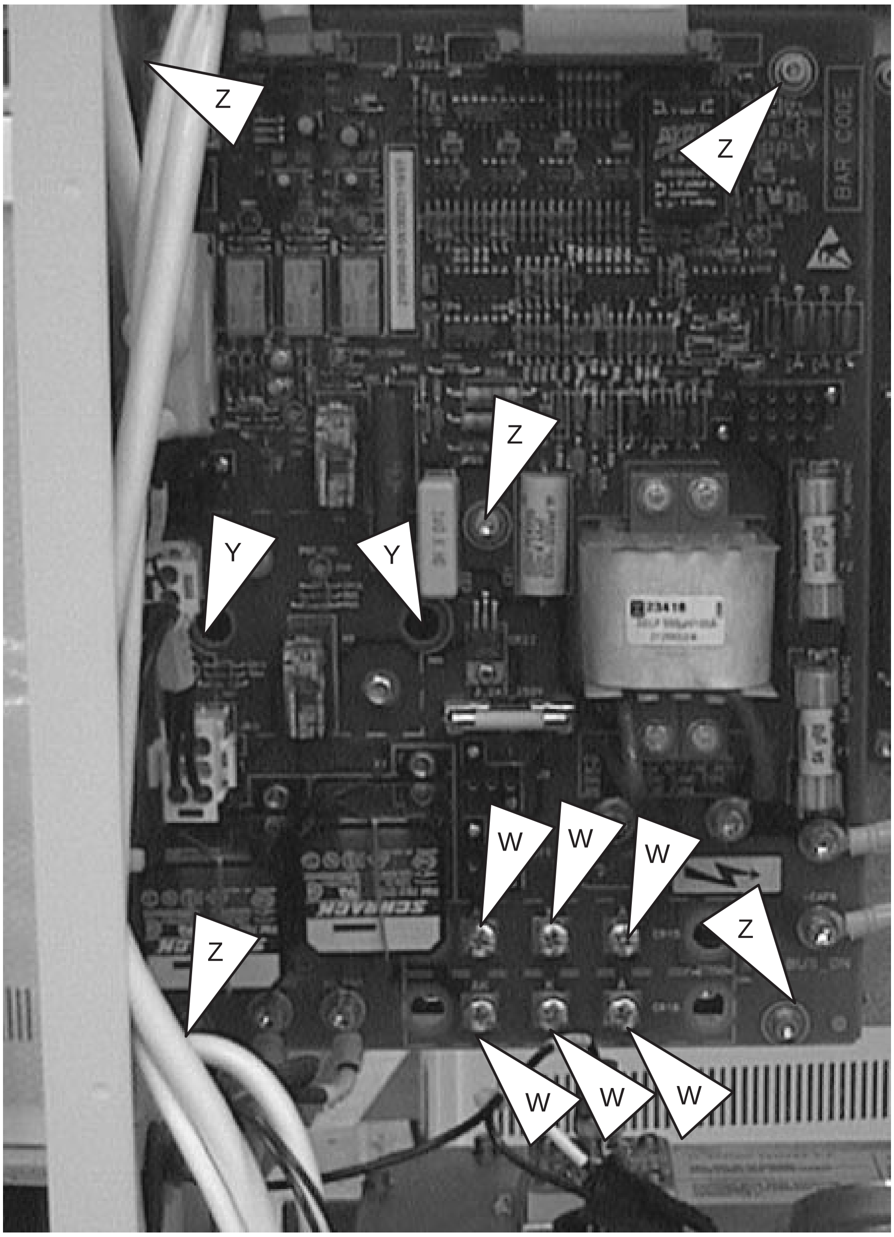
5.6 Installing the new 100R resistor

1. Installation is the reverse order of the removal procedure, except that you should apply heatsink compound to the contact surface of the resistor before screwing it onto the chassis.
2. Re-install the psu board.

DISASSEMBLY & RE-ASSEMBLY OF THE 300PL9 PSU BOARD, DIODE BRIDGE & RESISTOR 100R Job Card DR 030 3 of 4

ILLUSTRATION 1
LOCATION OF THE SECURING SCREWS





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Senographe 700T and 800T   Job Card DR 031   1 of 4

Purpose: **DISASSEMBLY & RE-ASSEMBLY OF THE PHOTOMULTIPLIER TUBE**	Version No.: Date: Dec. 18, 1995
Time: 30 min	Personnel: 1 field engineer

SECTION 1
SUPPLIES

- Renewal part photomultiplier tube

SECTION 2
TOOLS

- Engineer's standard toolkit
- Photomultiplier removal tool Part no. 56052519

SECTION 3
SPECIAL SAFETY PRECAUTIONS

- None

SECTION 4
PRE-REQUISITES

- Switch off the AC power to the Senographe before removing the Bucky from the arm.

SECTION 5
TASK DESCRIPTION

5.1 Removing the photomultiplier tube (referring to Illustration 1)

1. Remove the Bucky from the arm.
2. Undo the eight screws and remove the translucent cover.
3. Loosen four nuts and remove the handles (arrows 1) – noting that the one with the cut-out is on the left-hand side.
4. Disconnect the cable from 200PL5–J4.
5. Undo two the screws (arrow 2) on the slide.
6. Disconnect the ground cable (arrow 3).
7. Disconnect J1 & J3 from the board.
8. Undo the four screws securing the 200PL5 board to the assembly and remove the board.
9. Undo the screws on each side and a third one below the pcb, and remove the photomultiplier housing from the assembly.

Note: Do not adjust the Allen screw shown by arrow X – it is there to centralise the photomultiplier tube in its housing and must not be moved.

10. Use the photomultiplier removal tool to unscrew the end-cap from the tube housing.
11. Remove the black packing piece from the tube housing.
12. From the tube-base end of the housing, gently push the tube out of its base and remove it.

5.2 Installing the new tube

Installation of new tube is the reverse order of the removal procedure.

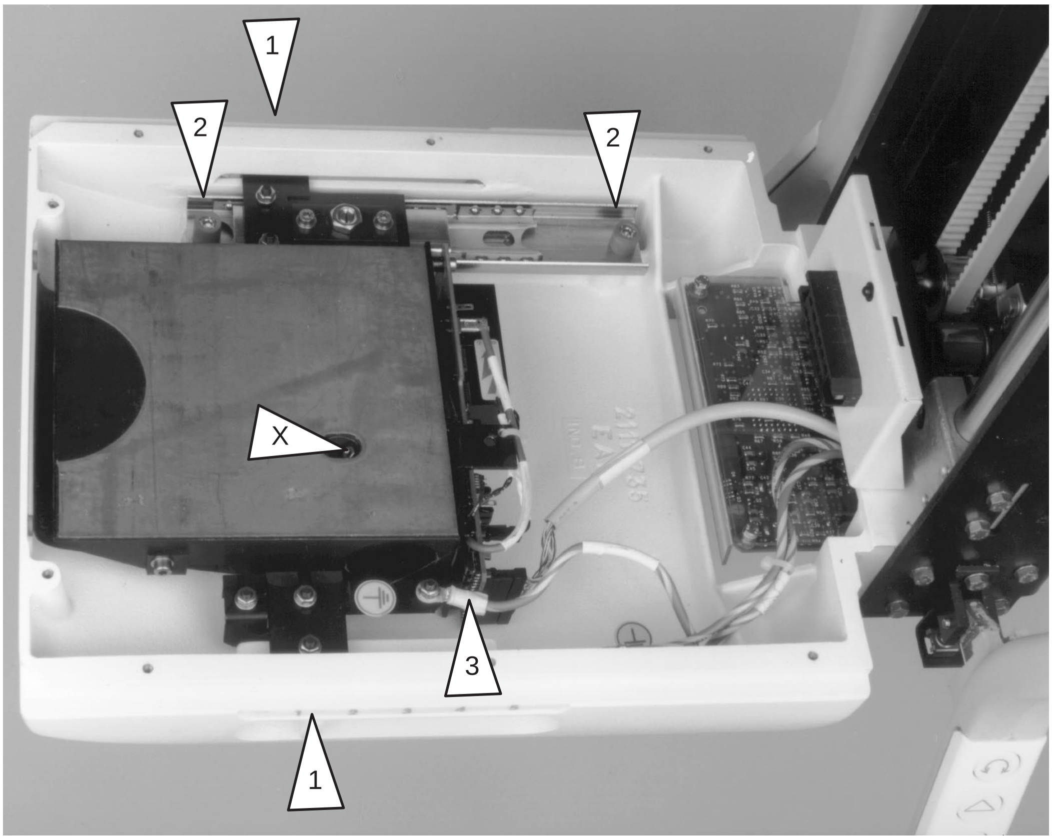
5.3 Calibration

To calibrate the new tube, perform the following Job Cards:

- CAL 005
- CAL 007
- CAL 014
- CAL 015

DISASSEMBLY & RE-ASSEMBLY OF THE PHOTOMULTIPLIER TUBE Job Card DR 031

ILLUSTRATION 1
LOCATION OF THE PHOTOMULTIPLIER TUBE



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Senographe 700T and 800T Job Card DR 032

Purpose: **DISASSEMBLY & RE-ASSEMBLY OF THE 200PL5 HTPM BOARD**	Version No.: Date: Dec. 18, 1995
Time: 0 h 20 min	Personnel: 1 field engineer

SECTION 1
SUPPLIES

- Renewal part HTPM board

SECTION 2
TOOLS

- Engineer's standard toolkit

SECTION 3
SPECIAL SAFETY PRECAUTIONS

- None

SECTION 4
PRE-REQUISITES

- Switch off the power to the Senographe before starting this procedure.

DISASSEMBLY & RE-ASSEMBLY OF THE 200PL5 HTPM BOARD	Job Card DR 032	2 of 4

SECTION 5
TASK DESCRIPTION

5.1 Removing the HTPM board (referring to Illustration 1)

1. Remove the Bucky from the arm.
2. Undo the eight screws and remove the translucent cover.
3. Disconnect the three cables W101, W219, W220 from the board.
4. Undo four screws and remove the board.

5.2 Installing the new HTPM board

1. Install the new board and secure it with the four screws.
2. Reconnect the three cables W101, W219, W220 to the board.

5.3 Calibrating the HTPM board

1. To calibrate the hardware, follow the procedures in CAL 004 & CAL 005.

Note: To avoid unnecessarily extensive calibration of the AEC (PM yield), some parameters can be modified manually.

2. Using either the Service Terminal or Console (from application mode), you can access the parameters you want to modify by making the following menu selections:

   SETUP/INSTAL/GENE/AOP/CELL/GAIN

The menu name is:

   PM GAIN DISPLAY (screen: @<00159)

   GAIN = +1.000E+0 (default value, unchanged after normal calibration)

3. Return to application mode and configure the Senographe as follows:
   - GF:Mo/Mo
   - 30Kv
   - 1 point mode
   - screen/film combination already calibrated
   - with grid
   - 4cm Plexiglas
   - configure the Senographe to display the pose technical parameters
   - insert a cassette with a screen and a blank film

DISASSEMBLY & RE-ASSEMBLY OF THE 200PL5 HTPM BOARD

Job Card DR 032

4. Execute a pose.
   - If the measured thickness is 40 ± 1mm, then the **GAIN** value is correct
   - If the measured thickness is outside the ± 1mm tolerance, then you must modify the **GAIN** value by ± 0.05 for each 1mm of deviation by:

     increasing the value of **GAIN** to decrease the measured thickness
     decreasing the value of **GAIN** to increase the measured thickness.

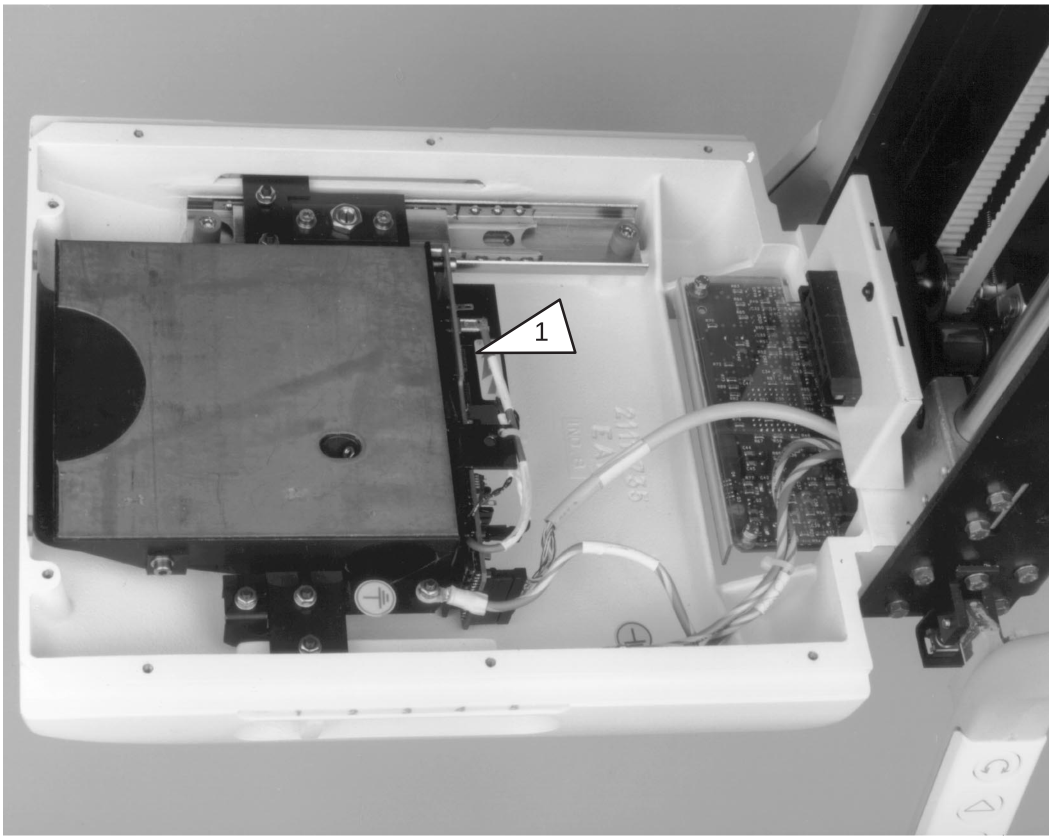
     For example:

     for a –4mm deviation, set **GAIN** = +0.800E+0 (= +8.00E–1)

     for a +6mm deviation, set **GAIN** = +1.300E+0

5. Follow the procedure in CAL 013 Chapter 6.5.5 to check that the calibration of the phototimer is correct.

ILLUSTRATION 1
LOCATION OF THE HTPM BOARD



6. Re-install the translucent cover and secure it with the eight screws.

DISASSEMBLY & RE-ASSEMBLY OF THE 200PL5 HTPM BOARD Job Card DR 032 4 of 4

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Senographe 700T and 800T Job Card DR 033 1 of 2

Purpose: **DISASSEMBLY & RE-ASSEMBLY OF THE LOW VOLTAGE PSU ASSEMBLY 300PL7**	Version No.: Date: Dec. 18, 1995
Time: x h xx min	Personnel: 1 field engineer

SECTION 1
SUPPLIES

- Renewal part PSU assembly

SECTION 2
TOOLS

- Engineer's standard toolkit

SECTION 3
SPECIAL SAFETY PRECAUTIONS

- None

SECTION 4
PRE-REQUISITES

- Switch off the AC power to the Senographe before starting this procedure.

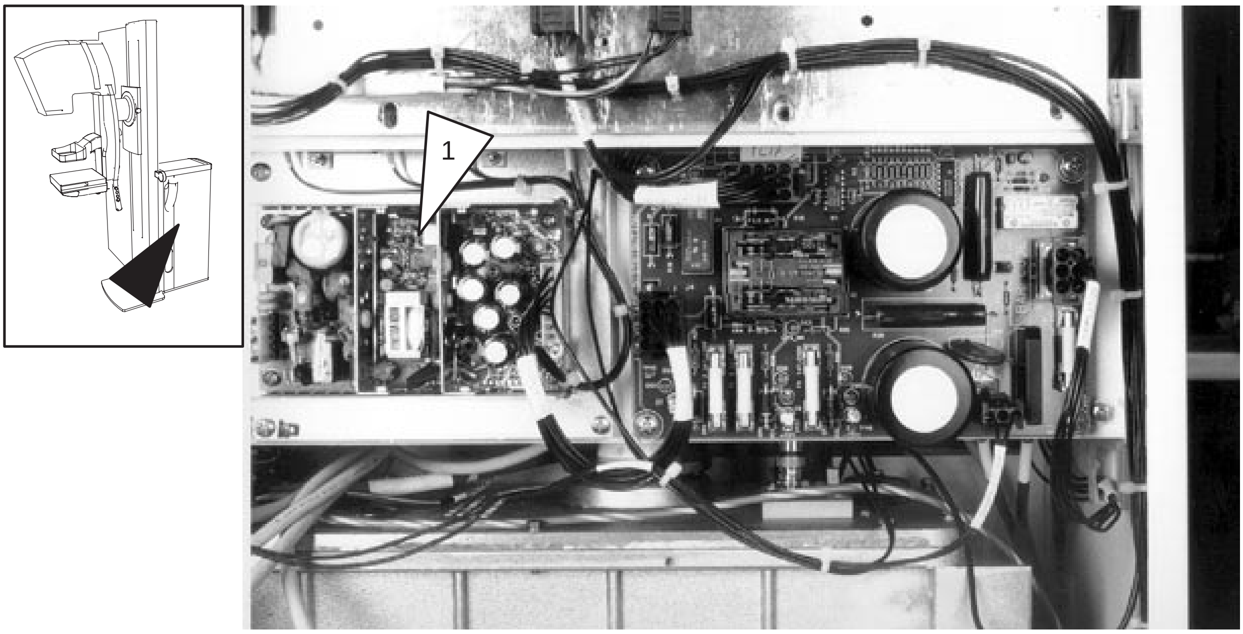
DISASSEMBLY & RE-ASSEMBLY OF THE LOW VOLTAGE PSU ASSEMBLY 300PL7 — Job Card DR 033

SECTION 5
TASK DESCRIPTION

5.1 Removing the psu assembly (referring to Illustration 1)

1. Disconnect the cables W30 & W31 from the psu.
2. Undo the four screws securing the psu mounting plate to the chassis and remove the complete assembly.

ILLUSTRATION 1
LOCATION OF THE LOW-VOLTAGE PSU



5.2 Installing the new psu assembly

Installation is the reverse order of the removal procedure.

5.3 +5 Volts adjustement

See CAL024.

CHAPTER 5 – RENEWAL PARTS

TABLE OF CONTENTS

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ABBREVIATIONS

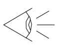
ITEM NO.	
–	Not illustrated.
– 6	Item No. 6 not illustrated.

FRU	Field Replaceable Unit.
1	Critical.
2	Not critical.
N	Not available.

REP	
Y	Repairable.

QTY	
PL	Previously listed as an assembly or subassembly.
AR	As required.

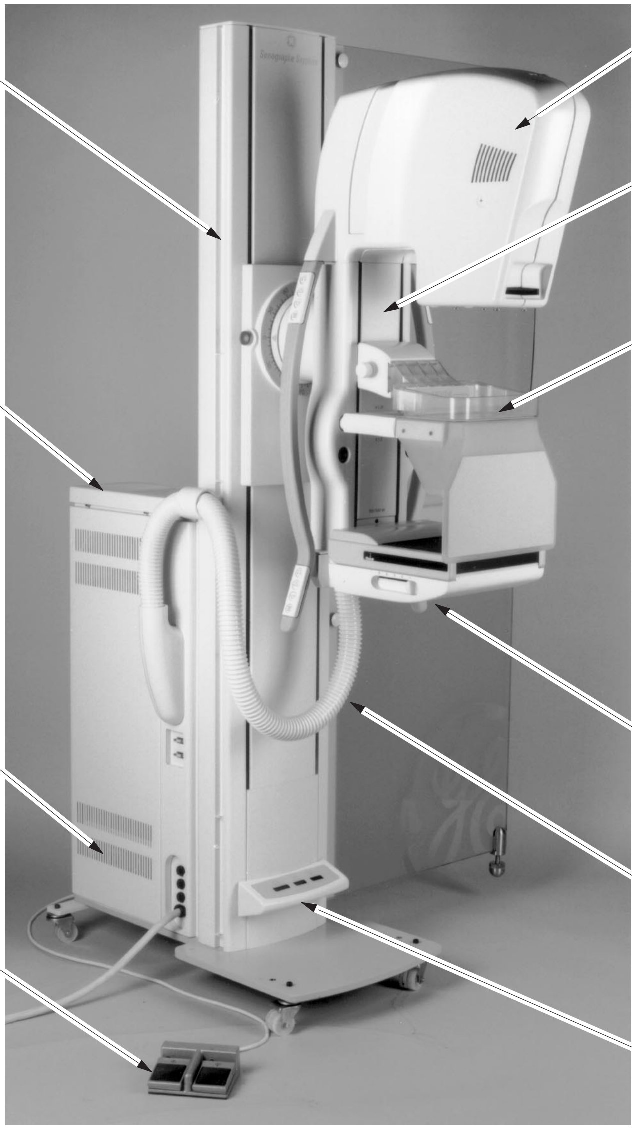
APP Applies to.

 Viewing direction.

Renewal Parts

APPLICABILITY	
A	Senographe 700T
B	Senographe 800T

ILLUSTRATION 5–1
LOCATION OF SUBASSEMBLIES



OPTIONAL ACCESSORIES
ILL. 5–27

100 CONTROL PANEL
ILL. 5–21

300 ELECTRONICS CABINET
ILL. 5–3 thru 5–5

300 PL2 LIGHT & ROTATION BOARD
ILL. 5–6

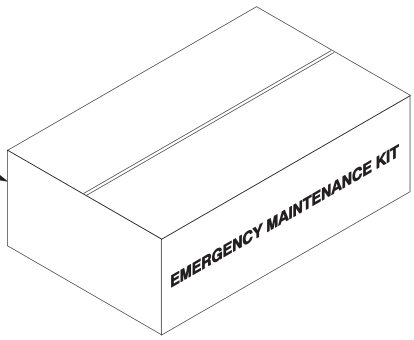
300PL1 ELEVATOR & COMPRESSION BOARD
ILL. 5–7

300PL17 LOW VOLTAGE DISTRIBUTION BOARD
ILL. 5–8

300 PL9 POWER SUPPLY BOARD
ILL. 5–9

MAINS FILTER EQUIPPED
ILL. 5–10

EMERGENCY MAINTENANCE KIT
ILL. 5–26



RENEWAL PARTS

ILLUSTRATION 5–2
SENOGRAPHE 700T 2122182
SENOGRAPHE 800T 2122184

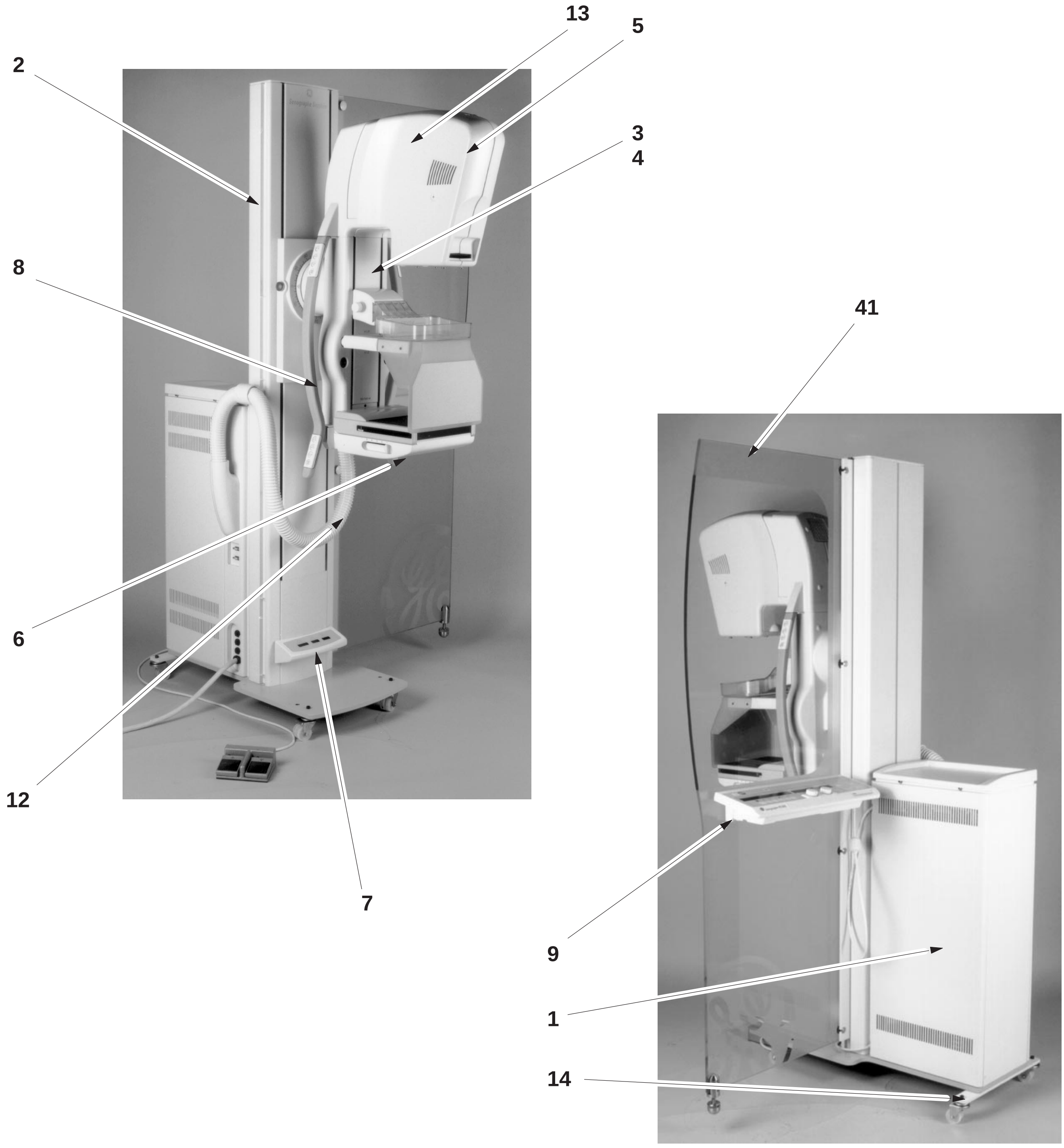


ILLUSTRATION 5–2
SENOGRAPHE 700T 2122182
SENOGRAPHE 800T 2122184

ITEM NO.	PART NO.	FRU	REP	DESCRIPTION 1 2 3 4 5	QTY	APP
–		N		SENOGRAPHE 700T	1	A
–		N		SENOGRAPHE 800T	1	B
1		N		• **300** ELECTRONICS CABINET (SEE ILL. 5–3 THRU 5–10)	1	A,B
2	2116102	2		• **200** COLUMN UNIT (SEE ILL. 5–11 THRU 5–13)	1	A,B
3		N		• **200** EXAMINATION ARM (SEE ILL. 5–14 THRU ILL. 5–16)	1	A
4		N		• **200** EXAMINATION ARM (SEE ILL. 5–14 THRU ILL. 5–16)	1	B
5		N		• **200** TUBE HOUSING SPACER (SEE ILL. 5–17 & ILL. 5–18)	1	A,B
6		N		• **200** IMAGE RECEPTOR (SEE ILL 5–19)	1	A,B
7	2138068	1		• READOUT UNIT (SEE ILL. 5–20)	1	B
8	2130315	1		• HANDLE ASSEMBLY	2	A,B
9	2107636	1	Y	• **100** CONSOLE CDRH (SEE ILL. 5–21)	1	A,B
– 10		N		• COVERS (SEE ILL. 5–22)	1	A,B
11	2124272	2		• CONDUIT CABLE (SEE ILL. 5–23)	1	A,B
12		N		• ACCESSORIES (SEE ILL. 5–24)		A,B
13	2133635	1		• X–RAY TUBE ASSEMBLY, MAXIRAY 70 TH–M (SEE ILL. 5–25)	1	A,B
14	91727258	2		• WHEEL, CASTER WHEEL DOUBLE D = 50 MM	4	A,B
– 15	2143982	2		• EMERGENCY MAINTENANCE KIT (SEE ILL. 5–26)	1	A,B
– 16	2147620	2		• IDENTIFICATION KIT	1	A
	2146900	2		• IDENTIFICATION KIT	1	B
–		N		• • IDENTIFICATION, AEC/AOP, CDRH PEOPLE	1	A,B
–		N		• • IDENTIFICATION, HV UNIT, CDRH PEOPLE	1	A,B
–		N		• • IDENTIFICATION, SENOGRAPHE PEARL/PEOPLE ASSY	1	A
–		N		• • IDENTIFICATION, SENOGRAPHE SA/PEOPLE ASSY	1	B
–		N		• • IDENTIFICATION, IMAGE RECEPTOR, CDRH	1	A,B
–		N		• • IDENTIFICATION LABEL (FRANCE)	1	A,B
–		N		• • SPECIFICATION LABEL, HOUSING/TUBE	1	A,B
–		N		• • CERTIFICATION LABEL, CDRH	1	A,B

RENEWAL PARTS

ILLUSTRATION **5–2**
SENOGRAPHE 700T 2122182 (Continued)
SENOGRAPHE 800T 2122184 (Continued)

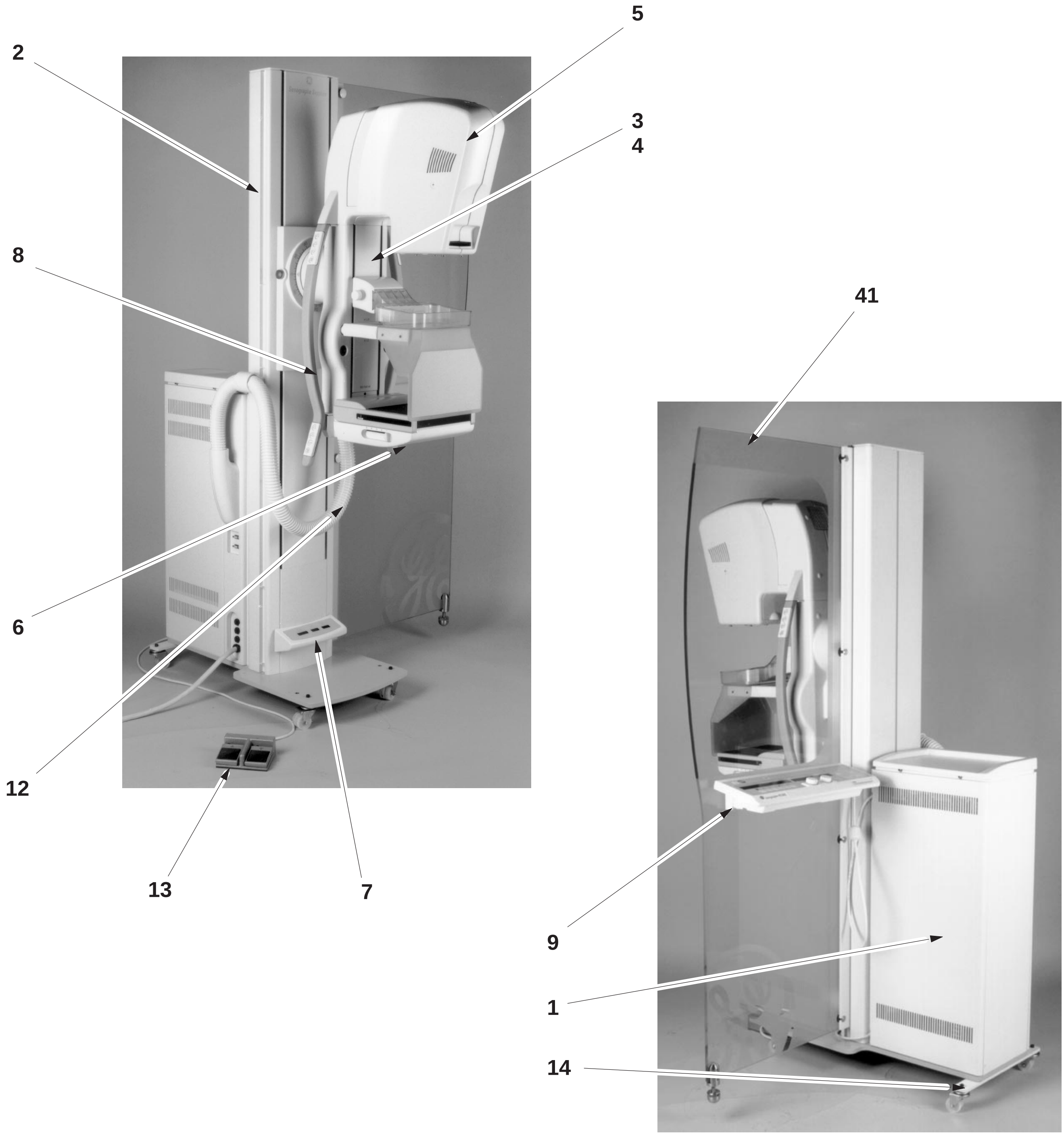


ILLUSTRATION 5–2
SENOGRAPHE 700T 2122182 (Continued)
SENOGRAPHE 800T 2122184 (Continued)

ITEM NO.	PART NO.	FRU	REP	DESCRIPTION 1 2 3 4 5	QTY	APP
– 17		N		• TECHNICAL PUBLICATION, SENOGRAPHE 700T & 800T		A,B
– 18	2135572–101	2		• • OPERATOR MANUAL (FRENCH)	1	A
– 19	2135575–101	2		• • OPERATOR MANUAL (FRENCH)	1	B
– 20	2135572–100	2		• • OPERATOR MANUAL (ENGLISH)	1	A
– 21	2135575–100	2		• • OPERATOR MANUAL (ENGLISH)	1	B
– 22	2135572–106	2		• • OPERATOR MANUAL (SPANISH)	1	A
– 23	2135575–106	2		• • OPERATOR MANUAL (SPANISH)	1	B
– 24	2135572–108	2		• • OPERATOR MANUAL (GERMAN)	1	A
– 25	2135575–108	2		• • OPERATOR MANUAL (GERMAN)	1	B
– 26	2135572–111	2		• • OPERATOR MANUAL (ITALIAN)	1	A
– 27	2135575–111	2		• • OPERATOR MANUAL (ITALIAN)	1	B
– 28	2135572–127	2		• • OPERATOR MANUAL (PORTUGUESE)	1	A
– 29	2135575–127	2		• • OPERATOR MANUAL (PORTUGUESE)	1	B
– 30	2146692–100	2		• • SERVICE MANUAL (ENGLISH)	1	B
– 31	2148335–100	2		• • SCHEMATICS	1	A,B
– 32	2148333–100	2		• • PIM	1	A,B
– 33	2143981	2		• SENOGRAPHE INSTALLATION KIT	1	A,B
–		N		• • SCREW JACK	4	A,B
–		N		• • JACK SUPPORT	4	A,B
–		N		• • CAP, BASE PLATE, D=12	6	A,B
–		N		• • SCREW, HEX SKT HD CAP M8X80/80, CHROME STL	8	A,B
–		N		• • WASHER, 26X11X4	4	A,B
–		N		• • STABILIZER	4	A,B
–		N		• • GROMMET	3	A,B
–		N		• • GROMMET	1	A,B
–		N		• • NEUTRAL METAL CYLINDER 10X38MM	1	A,B
–		N		• • BAG OF LANGUAGE STIK–ON LABLES	1	A,B
–		N		• • • GERMAN PRODUCT IDENTIFICATION LABEL	25	A,B
–		N		• • • ITALIAN PRODUCT IDENTIFICATION LABEL	25	A,B
–		N		• • • SPANISH PRODUCT IDENTIFICATION LABEL	25	A,B
–		N		• • • FRENCH PRODUCT IDENTIFICATION LABEL	25	A,B

RENEWAL PARTS

ILLUSTRATION **5–2**
SENOGRAPHE 700T 2122182 (Continued)
SENOGRAPHE 800T 2122184 (Continued)

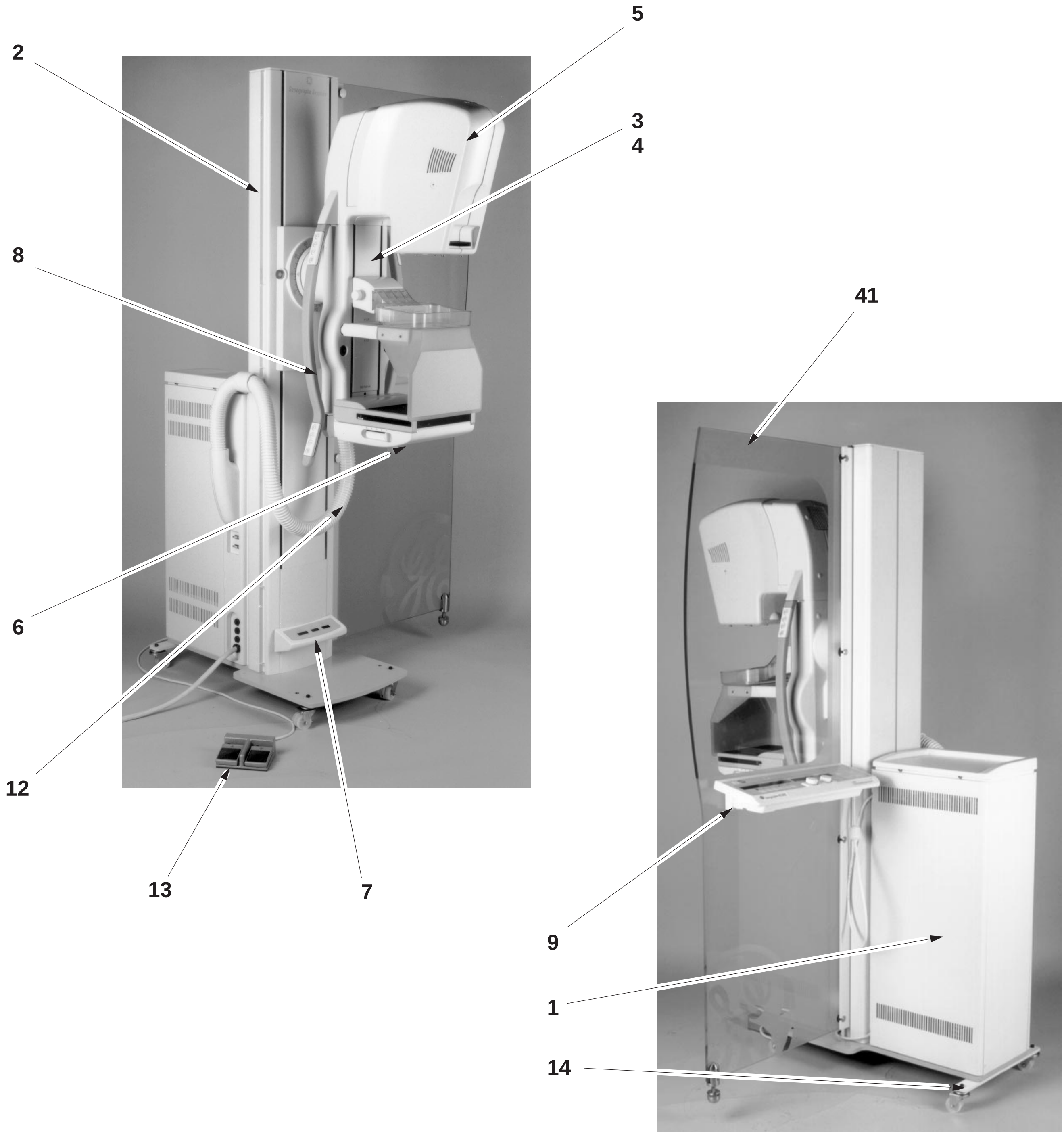
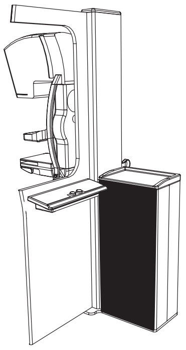


ILLUSTRATION 5–2
SENOGRAPHE 700T 2122182 (Continued)
SENOGRAPHE 800T 2122184 (Continued)

ITEM NO.	PART NO.	FRU	REP	DESCRIPTION 1 2 3 4 5	QTY	APP
–		N		• • • GERMAN PRODUCT SPECIFICATION LABEL	2	A,B
–		N		• • • ITALIAN PRODUCT SPECIFICATION LABEL	2	A,B
–		N		• • • SPANISH PRODUCT SPECIFICATION LABEL	2	A,B
–		N		• • • FRENCH PRODUCT SPECIFICATION LABEL	2	A,B
–		N		• • • OPERATING INSTRUCTIONS	1	A,B
–		N		• • TOOL	1	A,B
– 34	2149142	2		• SENOGRAPHE SITING INSTALLATION KIT	1	A,B
–		N		• • EXPANSION BOLT M10 ZAMAK D18X62	4	A,B
–		N		• • WASHER, FLAT M10N, PASS SST	4	A,B
–		N		• • SCREW, HEX SKT HD CAP M10X80/80, CHROME STL	4	A,B
– 35		N		• TOOL	1	A,B
– 36	2149718	1		• • HOLDER STAR PATTERN FOCUS 0.1 FOR SENOGRAPHE 700T & 800T		A,B
– 37	2149719	1		• • HOLDER STAR PATTERN FOCUS 0.3 FOR SENOGRAPHE 700T & 800T		A,B
– 38	2150115	1		• • DIAPHRAGM (SHUTTER) FOR SENOGRAPHE 700T & 800T		A,B
– 39	46–194427P407	1		• • SENSOR TYPE GAMMEX, RMI MODEL 817 (MAMMO COMPRES. SCAL)		A,B
– 40	36003399	1		• • HEATER CURRENT & BIAS TOOL		A,B
41		N		• OPTIONAL ACCESSORIES (SEE ILL. 5–27		A,B

RENEWAL PARTS

ILLUSTRATION 5–3
300 ELECTRONICS CABINET 2208859



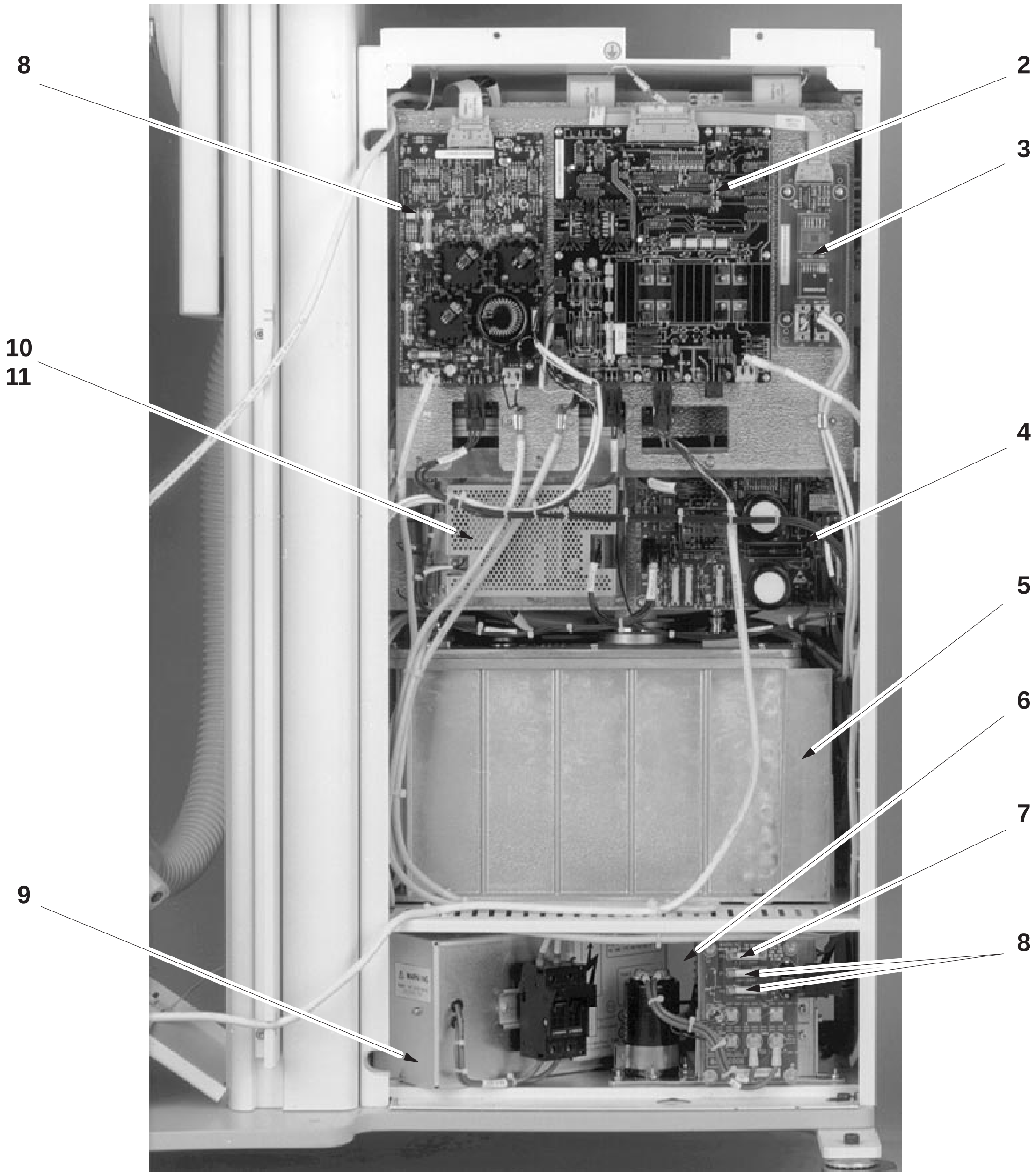
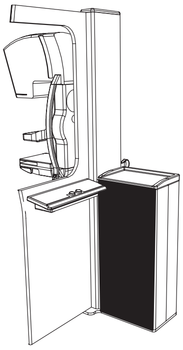


ILLUSTRATION 5–3
300 ELECTRONICS CABINET 2208859

ITEM NO.	PART NO.	FRU	REP	DESCRIPTION (1 2 3 4 5)	QTY	APP
–		N		**300** ELECTRONICS CABINET	PL	A,B
1	2147558	1	Y	• **300PL2** LIGHT & ROTATION BOARD (SEE ILL 5–6)	1	A,B
2	2208550	1	Y	• **300PL1** ELEVATOR & COMPRESSION BOARD (SEE ILL 5–7)	1	A,B
3	2111927	1		• **300PL3** COUNTER BOARD	1	AB
4	2141759–2	1	Y	• **300PL17** LOW VOLTAGE DISTRIBUTION BOARD (SEE ILL 5–8)	1	A,B
5	2142950	1	Y	• HIGH VOLTAGE TANK BONSAI (V1) CDRH	1	A,B
6	2128521	1		• **300PL13** EQUIPPED GANTRY POWER SUPPLY	1	A,B
7	99183931	1		• • SLOW–BLOW FUSE 6X32 3.2A 250V ULL	1	A,B
8	99183979	1		• • SLOW–BLOW FUSE 6X32 10A 250V ULL	2	A,B
9	2186117	1	Y	• MAINS FILTER EQUIPPED (SEE ILL. 5–10)	1	A,B
10	2147562	1		• LOW VOLTAGE POWER SUPPLY ASSEMBLY	1	A,B
11	2148403	1		• • FAST FUSE 5X20 3.15A 250V	1	A,B

RENEWAL PARTS

ILLUSTRATION 5–4
300 ELECTRONICS CABINET 2208859



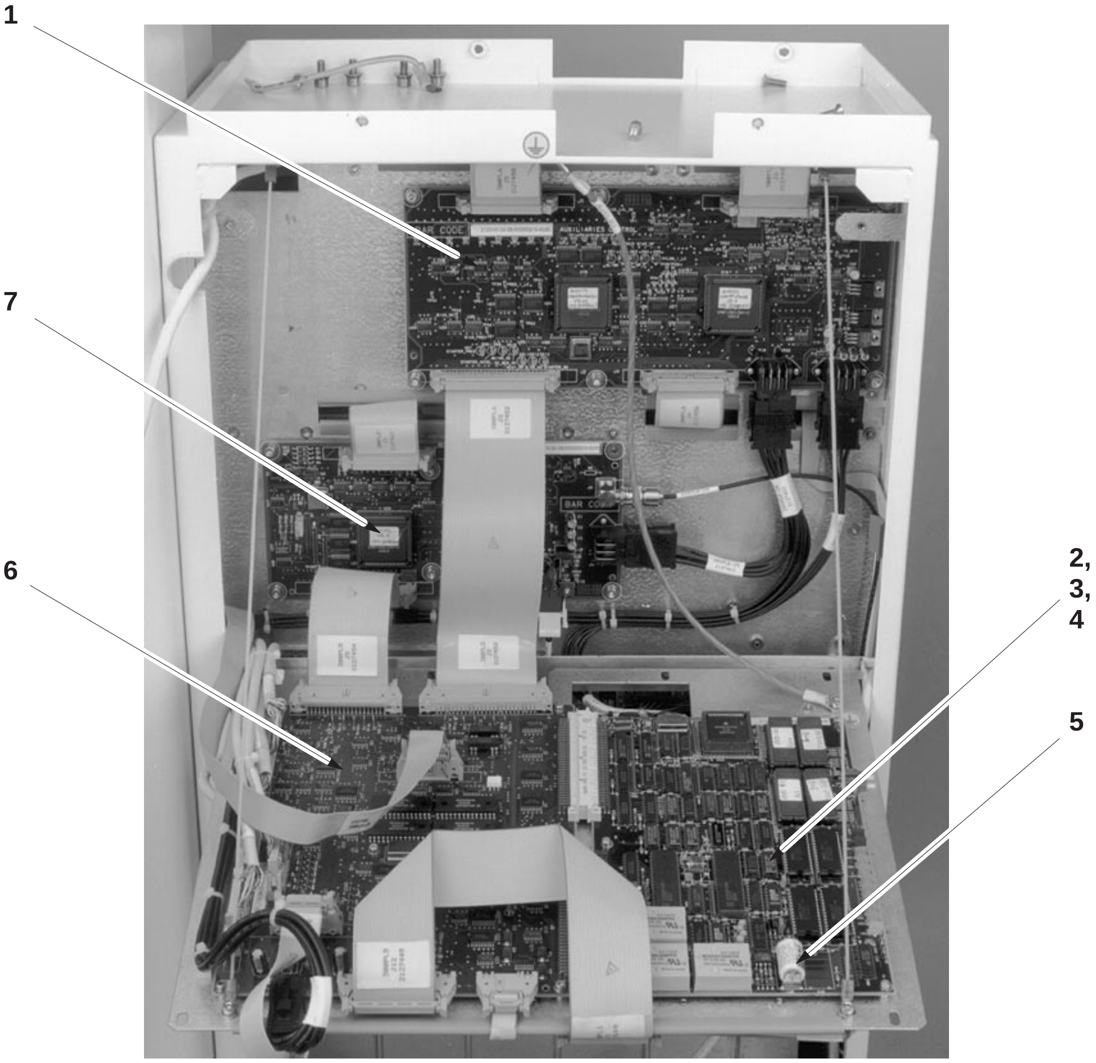
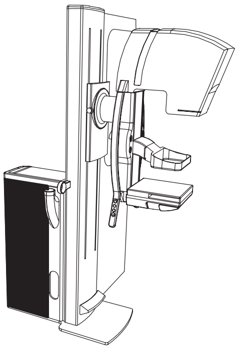


ILLUSTRATION 5–4
300 ELECTRONICS CABINET 2208859

ITEM NO.	PART NO.	FRU	REP	DESCRIPTION (1 2 3 4 5)	QTY	APP
–		N		**300** ELECTRONICS CABINET	PL	A,B
1	2149154	1	Y	• **300PL6** AUXILIARIES CONTROL BOARD	1	A,B
2	2127958–2	1	Y	• **300PL4** CPU BOARD – V 2.11	1	A,B
3	2127958–4	1	Y	• **300PL4** CPU BOARD – V 2.21	1	A,B
4	2127958–5	1	Y	• **300PL4** CPU BOARD – V 2.33	1	A,B
5	99171019	1		• • LITHIUM BATTERY 850 MAH	1	A,B
6	2202058–3	1	Y	• **300PL5** GENERATOR & ARM INTERFACE BOARD	1	A,B
7	2132779–2	1	Y	• **300PL8** HIGH VOLTAGE CONTROL BOARD	1	A,B
– 8	2147524	2		• SET OF CABLES W1, W2 & W3	1	A,B
–		N		• • CABLE W1 FROM 300PL5 J12 TO 300PL1 J1	1	A,B
–		N		• • CABLE W2 FROM 300PL5 J10 TO 300PL2 J1	1	A,B
–		N		• • CABLE W3 FROM 300PL5 J13 TO 300PL3 J1	1	A,B
– 9	2147523	2		• SET OF CABLES W4 & W6	1	A,B
–		N		• • CABLE W4 FROM 300PL5 J3 TO 300PL6 J2	1	A,B
–		N		• • CABLE W6 FROM 300PL5 J5 TO 300PL8 J2	1	A,B
– 10	2147522	2		• SET OF CABLES W8, W9, W10 & W19	1	A,B
–		N		• • CABLE W8 FROM 300PL6 J4 TO 300PL9 J4	1	A,B
–		N		• • CABLE W9 FROM 300PL6 J6 TO 300PL11 J1	1	A,B
–		N		• • CABLE W10 FROM 300PL6 J5 TO 300PL12 J1	1	A,B
–		N		• • CABLE W19 FROM 300PL8 J3 TO 300PL10 J1	1	A,B
– 11	2147546	2		• CABLE W11 FROM 300PL11 TO 300PL8 & TANK	1	A,B
– 12	2147542	2		• CABLE W16 FROM 300PL9 TO 300PL14	1	A,B
– 13	2147538	2		• CABLE W21 FROM 300PL8 TO 300PL15	1	A,B

RENEWAL PARTS

ILLUSTRATION 5–5
300 ELECTRONICS CABINET 2208859



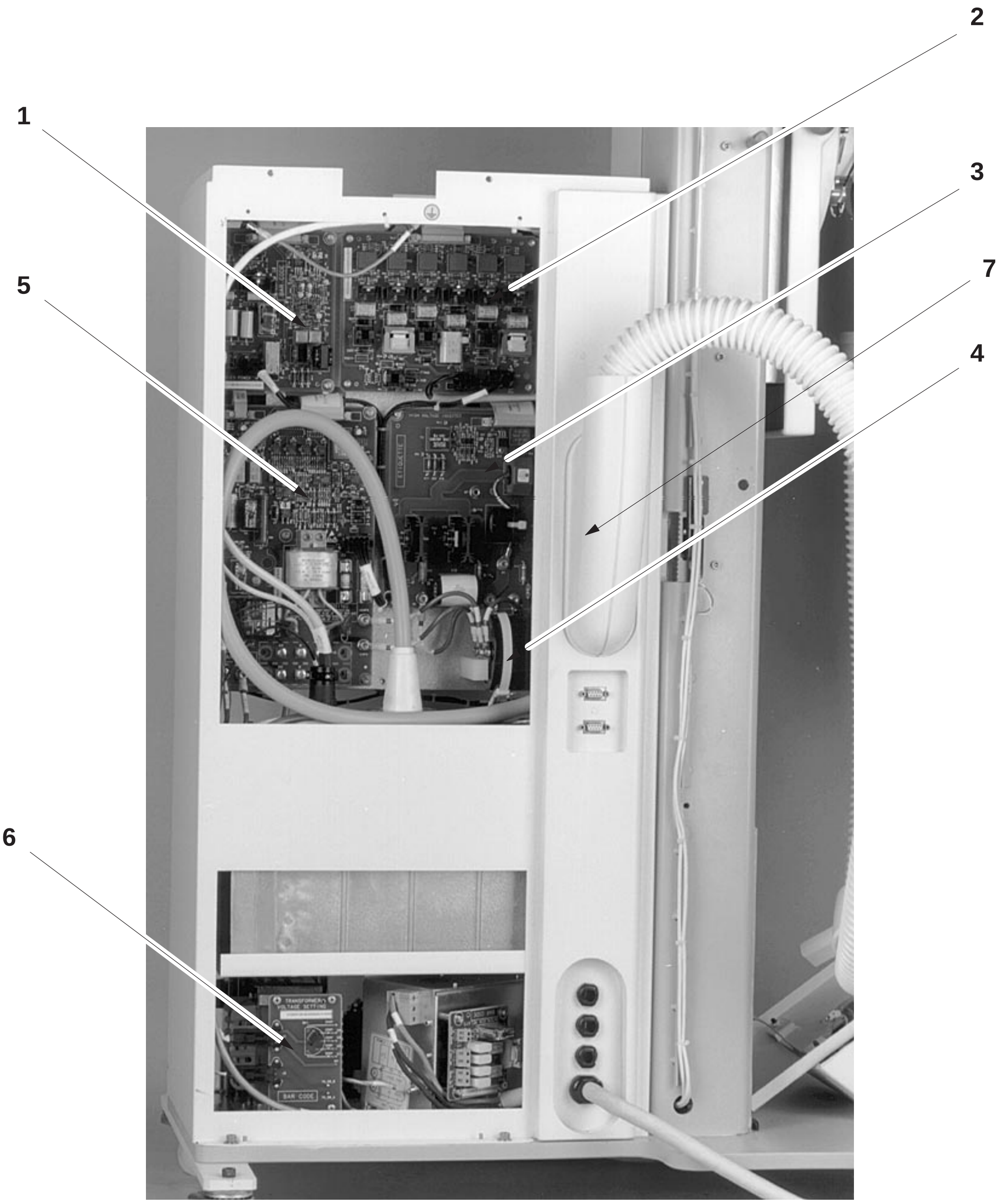
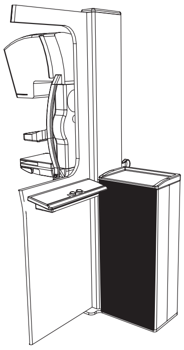


ILLUSTRATION 5–5
300 ELECTRONICS CABINET 2208859

ITEM NO.	PART NO.	FRU	REP	DESCRIPTION (1 2 3 4 5)	QTY	APP
–		N		**300** ELECTRONICS CABINET	PL	A,B
1	2132211	1	Y	• **300PL11** AUXILIARIES POWER BOARD	1	A,B
2	45553694	1	Y	• **300PL12** ANODE STARTER POWER BOARD	1	A,B
3	2145826-3	1	Y	• **300PL10** HIGH VOLTAGE INVERTER BOARD	1	A,B
4	2107810	1		• CAPACITOR 4700 µF/400V	1	A,B
5	2149388–3	1	Y	• **300PL9** POWER SUPPLY BOARD (SEE ILL 5–9)	1	A,B
6	2128063	1		• **300T1** EQUIPPED WITH 300PL18	1	A,B
7	2136346	2		• CHIMNEY	1	

RENEWAL PARTS

ILLUSTRATION 5–6
300PL2 LIGHT & ROTATION BOARD 2147558



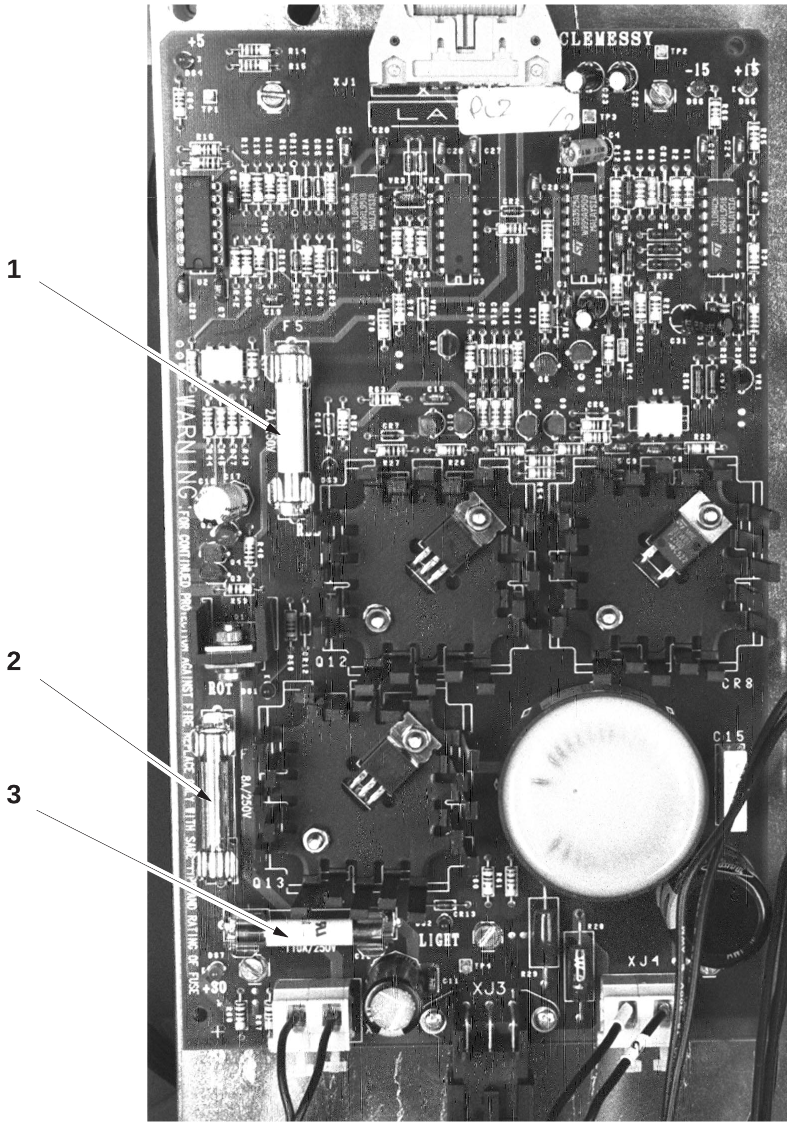
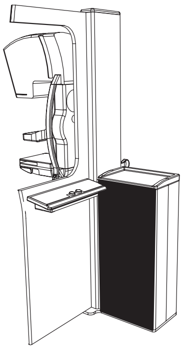


ILLUSTRATION 5–6
300PL2 LIGHT & ROTATION BOARD 2147558

ITEM NO.	PART NO.	FRU	REP	DESCRIPTION 1 2 3 4 5	QTY	APP
–	2147558	1	Y	**300PL2** LIGHT & ROTATION BOARD	PL	A,B
1	2146116–2	1		• FAST FUSE 6X32 2A 250V ULL (F5)	1	A,B
2	2146116–5	1		• FAST FUSE 6X32 8A 250V ULL (F1)	1	A,B
3	99183979	1		• SLOW–BLOW FUSE 6X32 10A 250V ULL (F6)	1	A,B

ILLUSTRATION 5–7
300PL1 ELEVATOR & COMPRESSION BOARD 2147559



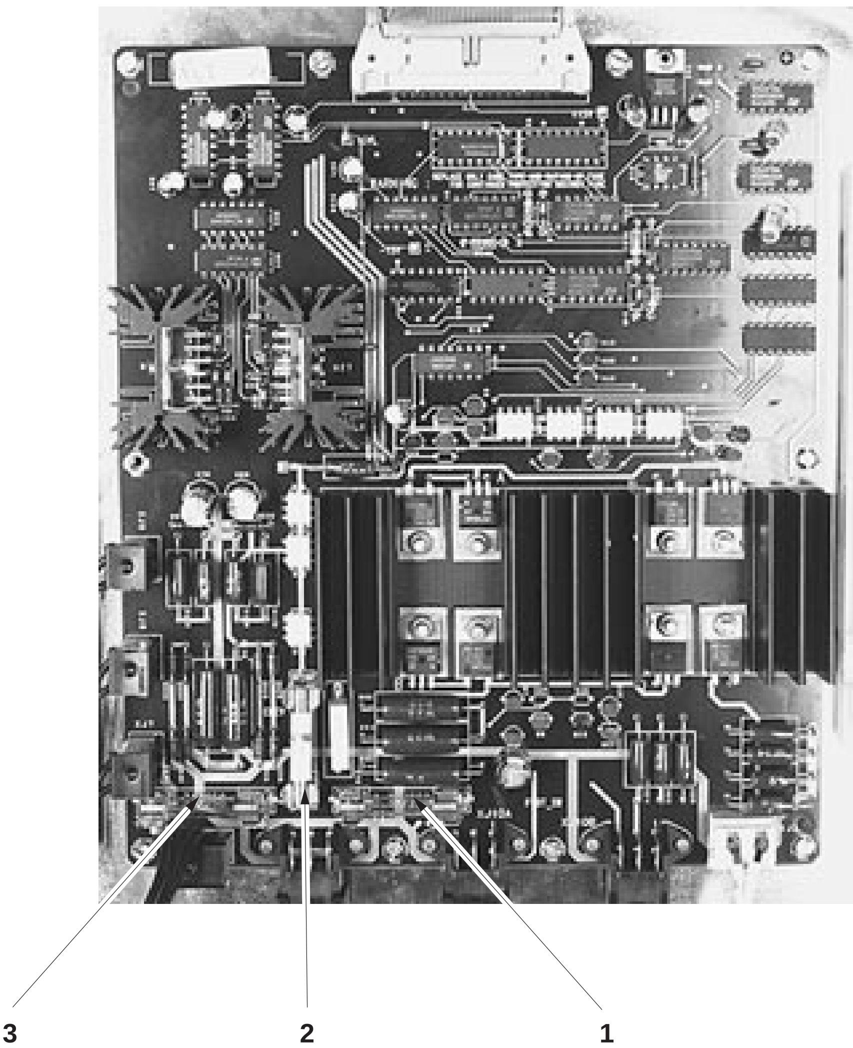
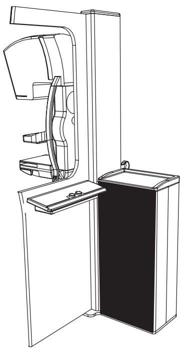


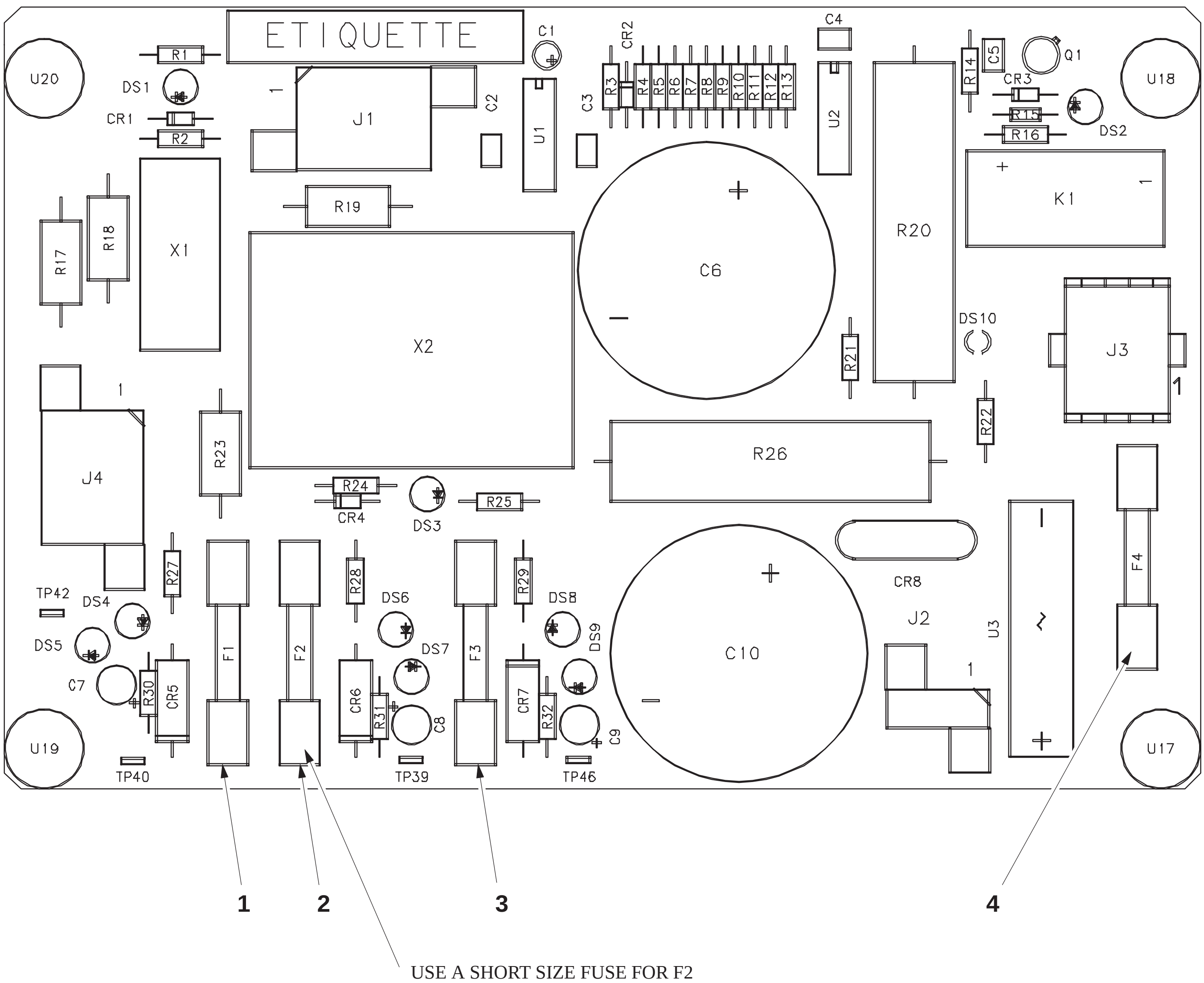
ILLUSTRATION 5–7
300PL1 ELEVATOR & COMPRESSION BOARD 2147559

ITEM NO.	PART NO.	FRU	REP	DESCRIPTION 1 2 3 4 5	QTY	APP
–	2147559	1	Y	**300PL1** ELEVATOR & COMPRESSION BOARD	PL	A,B
1	2146116	1		• FAST FUSE 6X32 0.32A 250V ULL (F1)	1	A,B
2	2146116–3	1		• FAST FUSE 6X32 3.0A 250V ULL (F2)	1	A,B
3	99183979	1		• SLOW–BLOW FUSE 6X32 10A 250V ULL (F3)	1	A,B

RENEWAL PARTS

ILLUSTRATION 5–8
300PL17 LOW VOLTAGE DISTRIBUTION BOARD 2141759





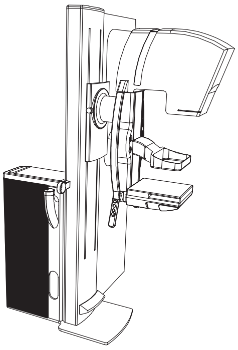
USE A SHORT SIZE FUSE FOR F2

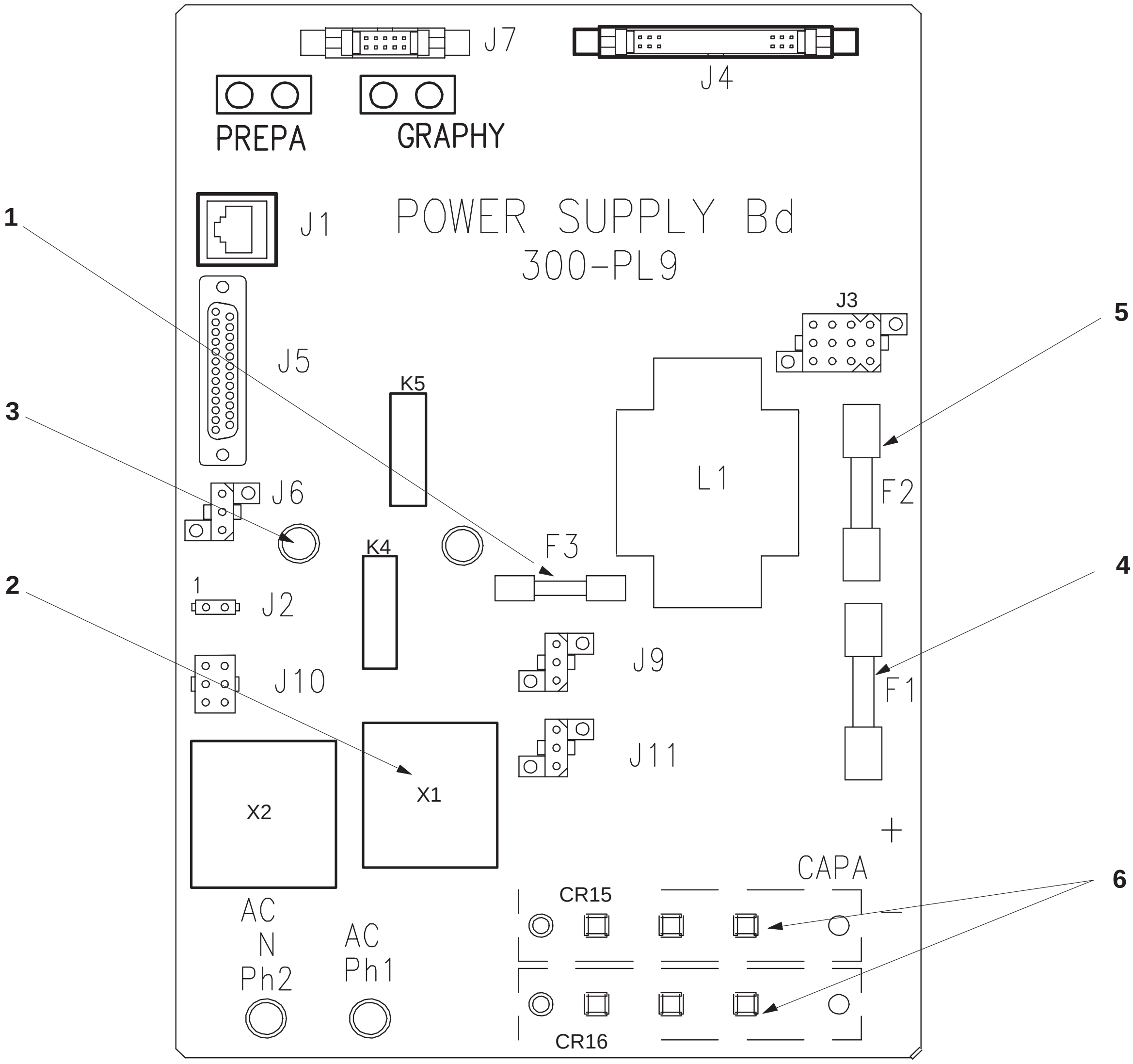
ILLUSTRATION 5–8
300PL17 LOW VOLTAGE DISTRIBUTION BOARD 2141759

ITEM NO.	PART NO.	FRU	REP	DESCRIPTION 1 2 3 4 5	QTY	APP
–	2141759	1	Y	**300PL17** LOW VOLTAGE DISTRIBUTION BOARD	PL	A,B
1	99183931	1		• SLOW–BLOW FUSE 6X32 3.2A 250V ULL (F1)	1	A,B
2	46–267217P21	1		• SLOW–BLOW FUSE 5X20 3.15A 250V ULL (F2)	1	A,B
3	99183936	1		• SLOW–BLOW FUSE 6X32 1.0A 250V ULL (F3)	1	A,B
4	99183928	1		• SLOW–BLOW FUSE 6X32 2A 250V ULL (F4)	1	A,B

RENEWAL PARTS

ILLUSTRATION 5–9
300PL9 POWER SUPPLY BOARD 2149388–3



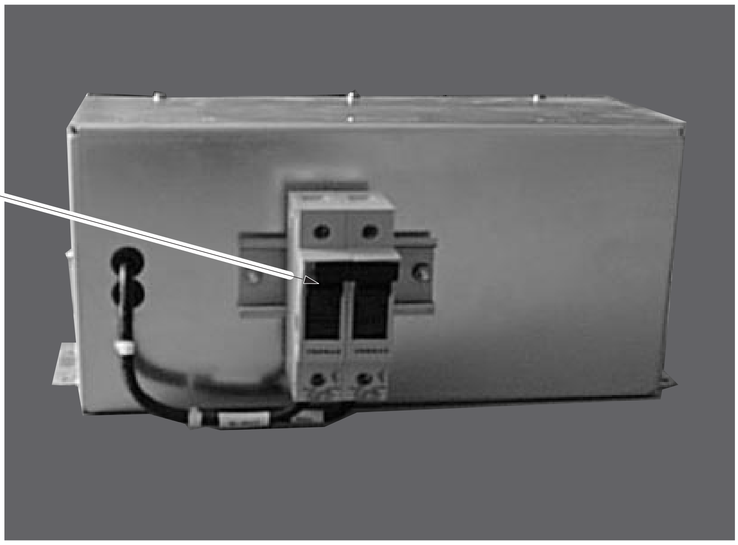


RENEWAL PARTS

ILLUSTRATION 5–9
300PL9 POWER SUPPLY BOARD 2149388–3

ITEM NO.	PART NO.	FRU	REP	DESCRIPTION 1 2 3 4 5	QTY	APP
–	**2149388–3**	1	Y	**300PL9** POWER SUPPLY BOARD	PL	A,B
1	99183931	1		• SLOW–BLOW FUSE 6X32 3.2A 500V ULL (F3)	1	A,B
2	91682082	1		• RELAY 12VDC 3RT 16A CI	1	A,B
3	2115822	1		• RESISTOR 100R 10% 250W MET 5KV	1	A,B
4	2149559–2	1		• FAST FUSE 10X38 5A 700V ULL (F1)	1	A,B
5	2149559	1		• FAST FUSE 10X38 10A 700V ULL (F2)	1	A,B
6	2113660	1		• DIODE BRIDGE SINGLE PHASE 600V 60A	2	A,B

ILLUSTRATION 5–10
MAINS FILTER EQUIPPED 2186117



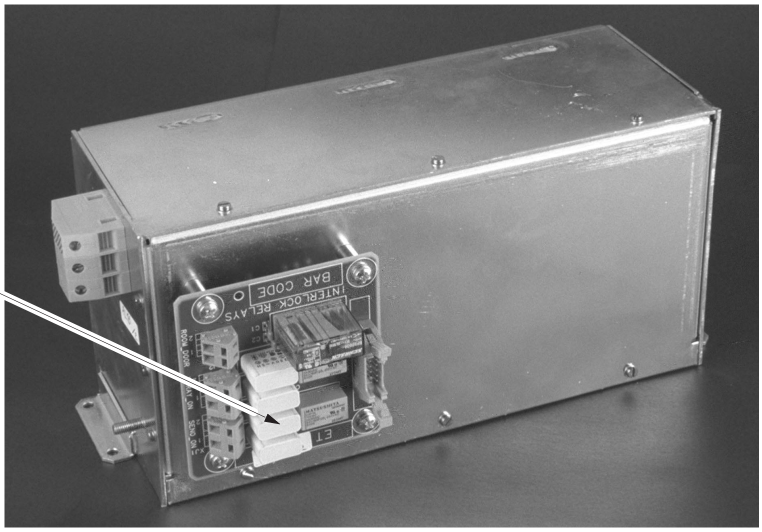
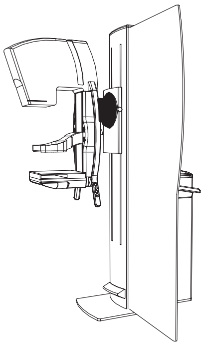


ILLUSTRATION 5–10
MAINS FILTER EQUIPPED 2186117

ITEM NO.	PART NO.	FRU	REP	DESCRIPTION 1 2 3 4 5	QTY	APP
–	2186117	1	Y	MAINS FILTER EQUIPPED	PL	A,B
1	2130696–2	1		• 300 PL14 INTERLOCK RELAYS BOARD	1	A,B
2	2185337	1		• MAINS FUSE DISCONNECTOR 10X38 600V UL	1	A,B
3	99175457	1		• MAINS FUSE 10X38 25A 600V C (300–F1 & 300–F2)	2	A,B

RENEWAL PARTS

ILLUSTRATION 5–11
200 COLUMN UNIT 2208628



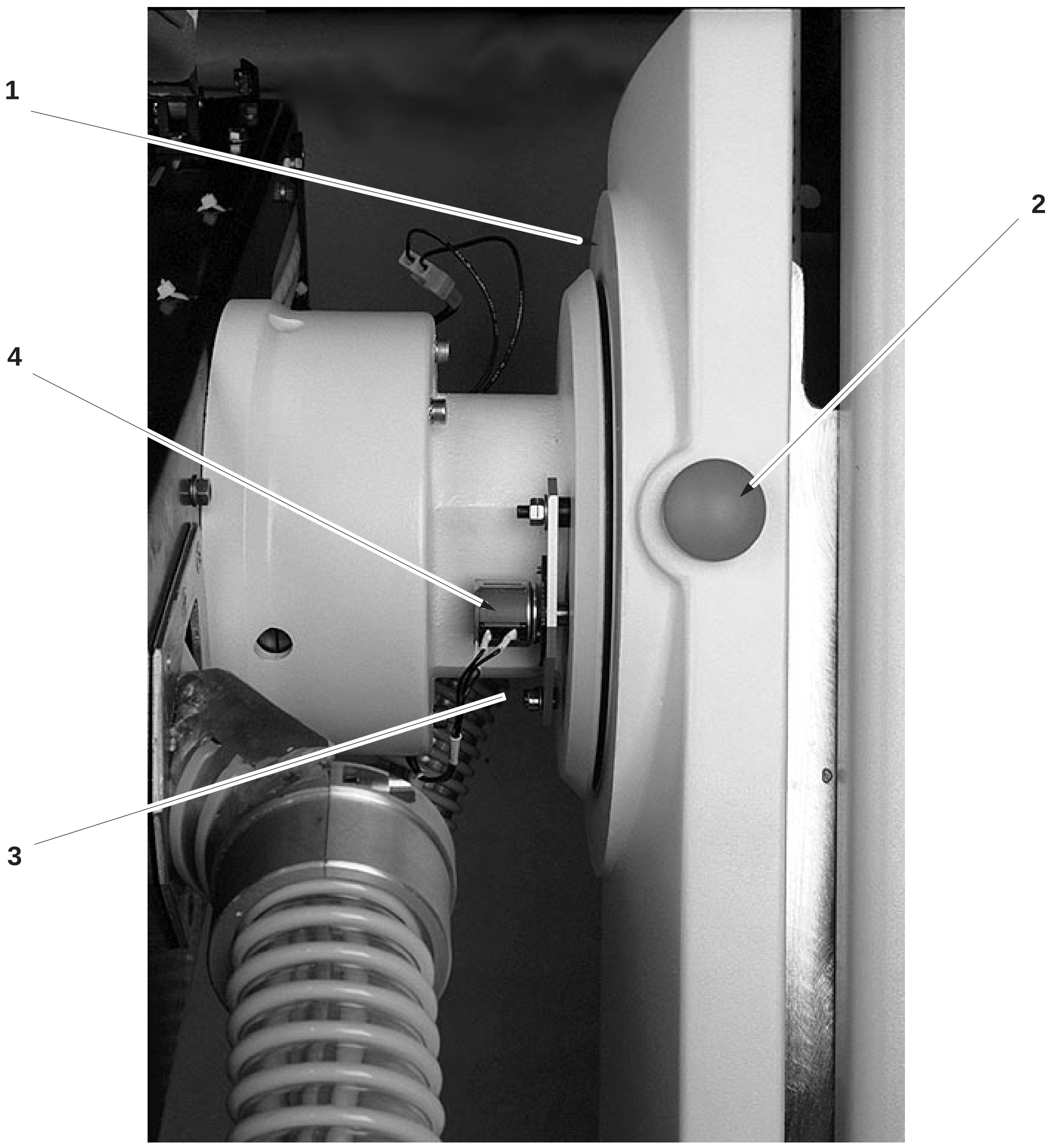
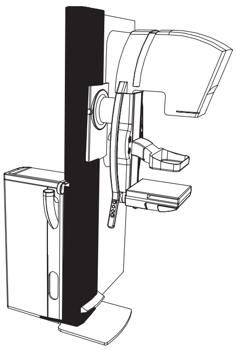


ILLUSTRATION 5–11
200 COLUMN UNIT 2208628

ITEM NO.	PART NO.	FRU	REP	DESCRIPTION 1 2 3 4 5	QTY	APP
–	2208628	2		**200** COLUMN UNIT	PL	A,B
1	2139536	2		• ANGULATION SILKSCREEN PRINTING	1	A,B
2	2124284	1		• WIRED EMERGENCY BUTTON	2	A,B
3	2116118	2		• ANGULATION GEARWHEEL ASSEMBLY	1	A,B
4	2124352	1		• WIRED ANGULAR POTENTIOMETER	1	B

RENEWAL PARTS

ILLUSTRATION 5–12
200 COLUMN UNIT 2208628



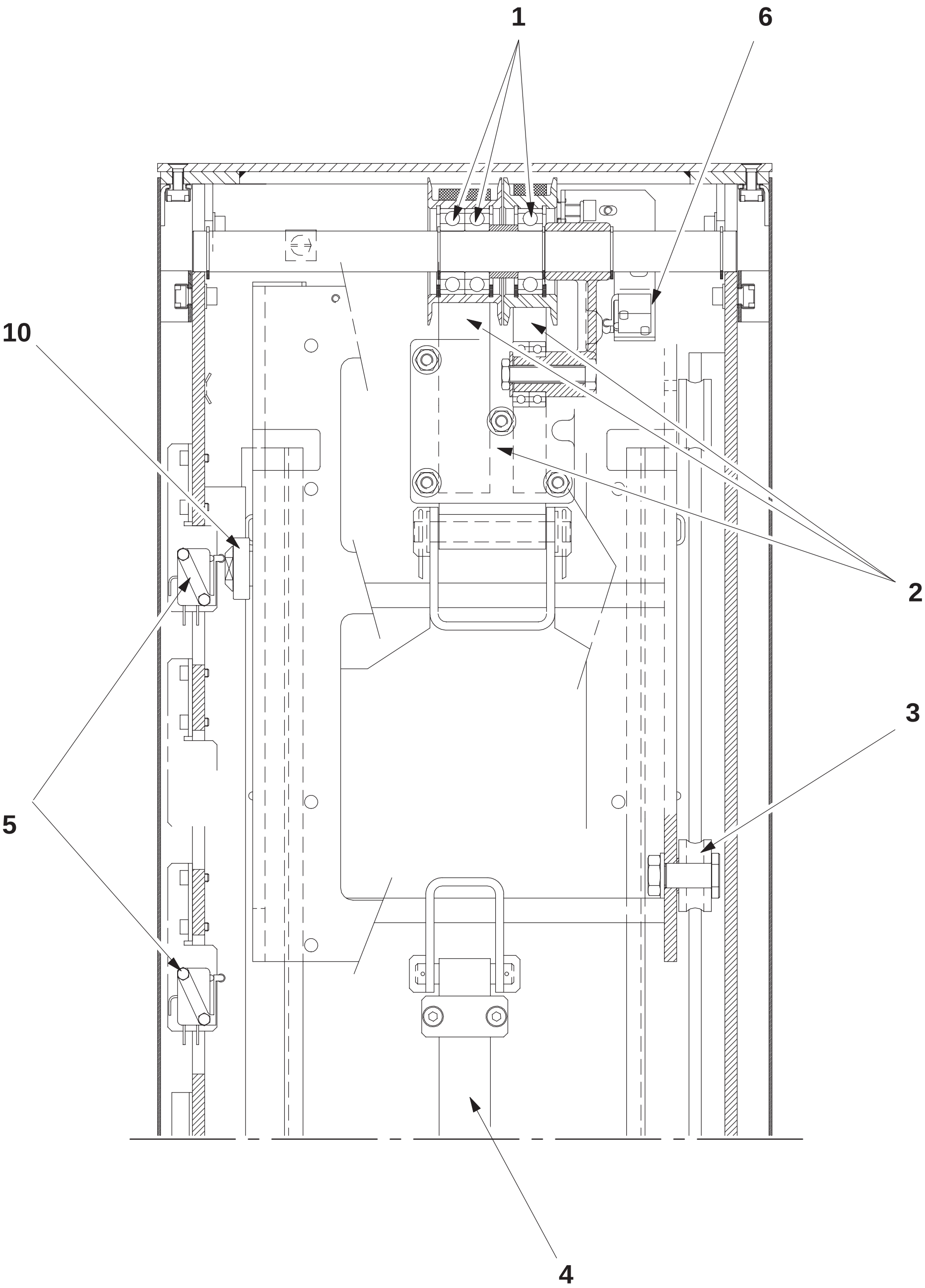
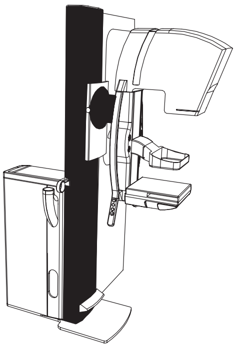


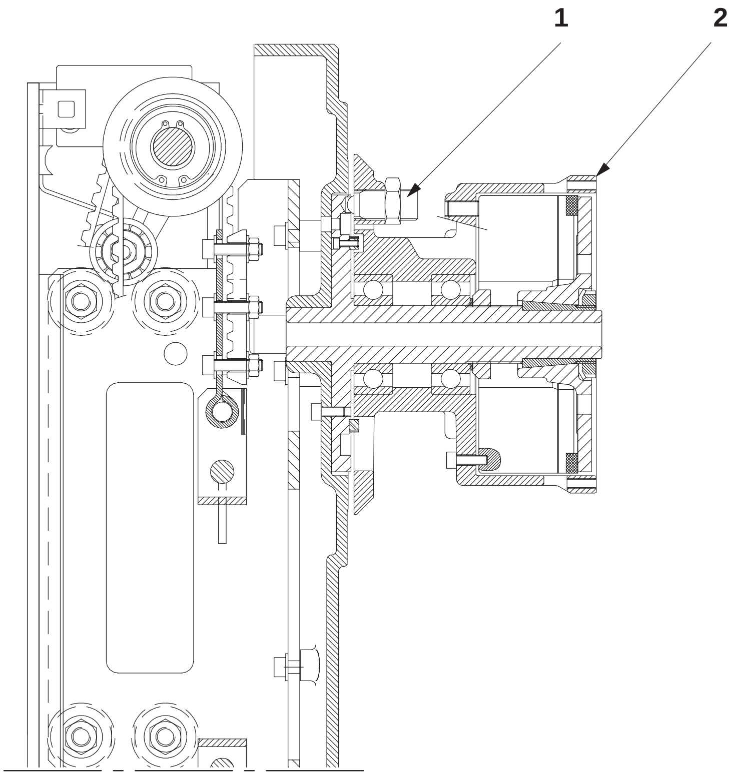
ILLUSTRATION 5–12
200 COLUMN UNIT 2208628

ITEM NO.	PART NO.	FRU	REP	DESCRIPTION 1 2 3 4 5	QTY	APP
–	2208628	2		**200** COLUMN UNIT	PL	A,B
1	99037684	2		• BALL BEARING 20X42X12 1–ROW	1	A,B
2	2189425	2		• SUSPENSION BELTS ASSEMBLY	1	A,B
3	2146719	2		• ROLLER 12X55X16 2–ROW	4	A,B
4	2116126	2		• ELEVATOR DRIVE MOTOR BELT	1	A,B
5	2135971	1		• MICROSWITCH 1RT 8A 46V F6X0.8	2	A,B
6	2135971	1		• ELEVATOR SECURITY MICROSWITCH	1	A,B
– 7	2124270	2		• W111 ELEVATOR (SWITCH HIGH) CABLE	1	A,B
– 8	2124271	2		• W112 ELEVATOR (SWITCH LOW) CABLE	1	A,B
– 9	2124322	2		• W113 ELEVATOR (SECURITY) CABLE	1	A,B
10	2146791	2		• ROLLER 13X30X8 1–ROW	2	A,B
– 11	2153971	1		• PIN	6	A,B
– 12	2116651	2		• LOCKING ROD	1	A,B

RENEWAL PARTS

ILLUSTRATION 5–13
200 COLUMN UNIT 2208628





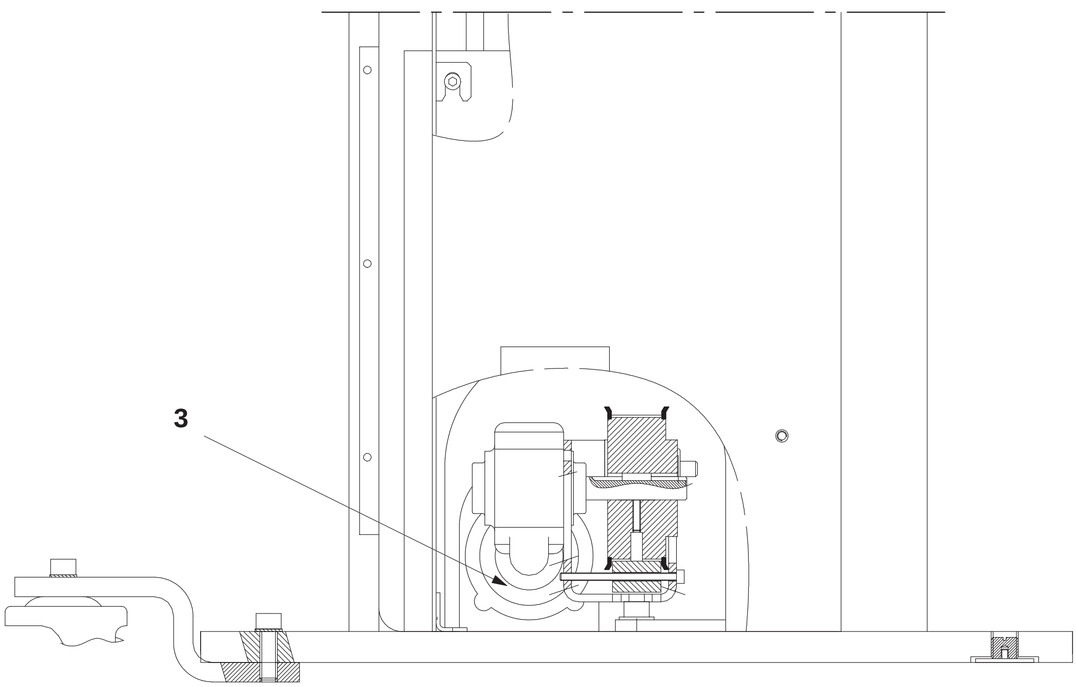
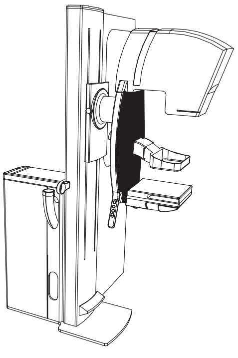


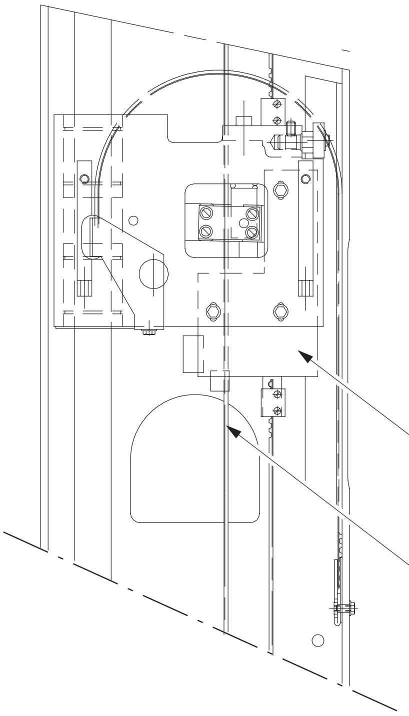
ILLUSTRATION 5–13
200 COLUMN UNIT 2208628

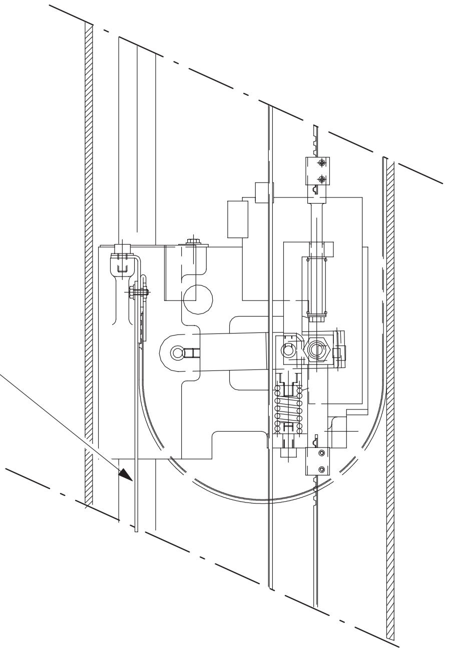
ITEM NO.	PART NO.	FRU	REP	DESCRIPTION 1 2 3 4 5	QTY	APP
–	2208628	2		**200** COLUMN UNIT	PL	A,B
1	91508844	1		• BALL–LATCH	1	A,B
2	2175314	2		• BRAKE AND ROTATION BOX ASSEMBLY	1	A,B
3	2180542	1		• ELEVATOR GEARED MOTOR ASSEMBLY WITH SOFT. V2.11	1	A,B
4	2207275	1		• ELEVATOR GEARED MOTOR ASSEMBLY WITH SOFT. V2.21 AND LATER	1	A,B
– 5	2116130	2		• PLASTIC GUIDE	1	A,B
– 6	2227082	2		• SMALL TOP COUNTERWEIGHT	1	A,B
– 7	2135088	2		• LARGE UPPER COUNTERWEIGHT	1	A,B
– 8	2227083	2		• SMALL LOWER COUNTERWEIGHT	1	A,B

RENEWAL PARTS

ILLUSTRATION 5–14
200 EXAMINATION ARM 2147433
200 EXAMINATION ARM 2140057







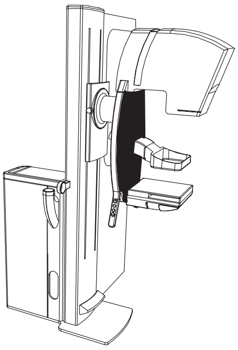
RENEWAL PARTS

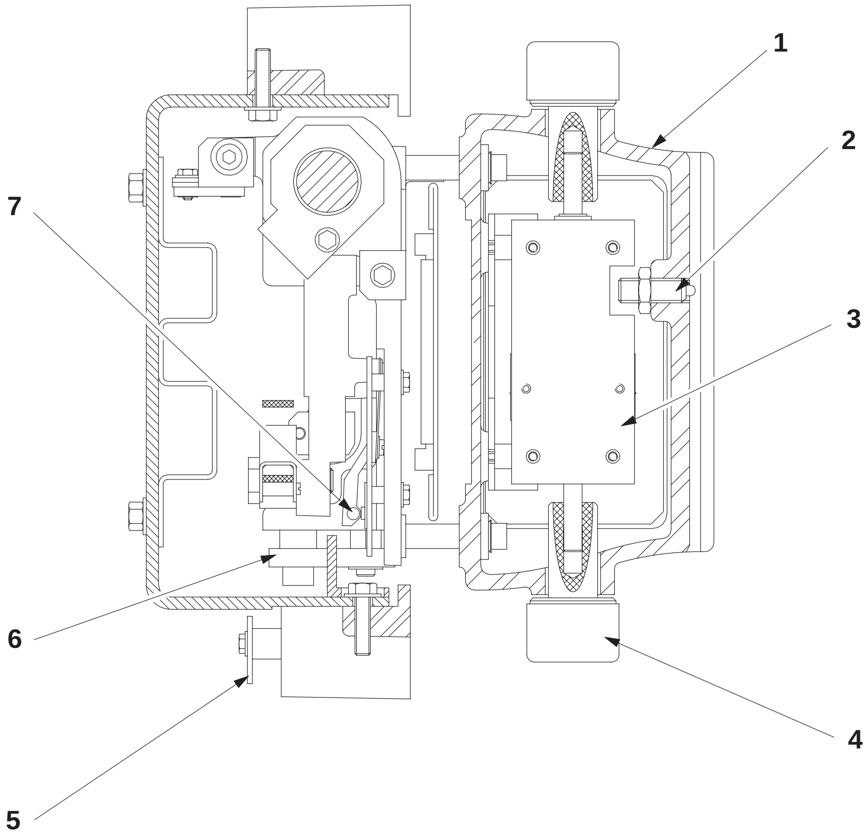
ILLUSTRATION 5–14
200 EXAMINATION ARM 2147433
200 EXAMINATION ARM 2140057

ITEM NO.	PART NO.	FRU	REP	DESCRIPTION (1 2 3 4 5)	QTY	APP
–		N		**200** EXAMINATION ARM	PL	A
–		N		**200** EXAMINATION ARM	PL	B
1	2111935–2	1		• **200PL7** COMPRESSION SENSOR BOARD	1	A,B
2	2132430	1		• COMPRESSION MAIN BELT	1	A,B
3	2138366	1		• FLAT CABLE ASSEMBLY	1	A,B
– 4		N		• • BELT SUPPORT	1	A,B
– 5		N		• • TOOTHED BELT	1	A,B
– 6		N		• • FLANGE	1	A,B
– 7		N		• • W213 CABLE FROM 200PL1 J3 TO 200PL7 J1	1	A,B
– 8		N		• • W225 GROUND CABLE	1	A,B

RENEWAL PARTS

ILLUSTRATION 5–15
200 EXAMINATION ARM 2147433
200 EXAMINATION ARM 2140057





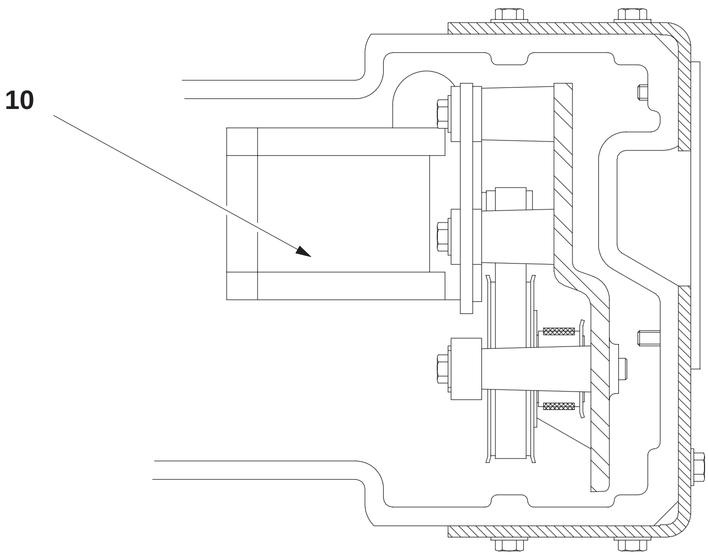
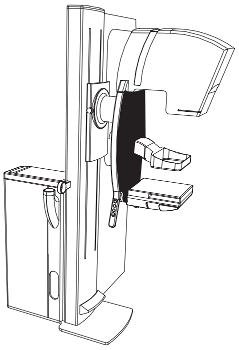


ILLUSTRATION 5–15
200 EXAMINATION ARM 2147433
200 EXAMINATION ARM 2140057

ITEM NO.	PART NO.	FRU	REP	DESCRIPTION (1 2 3 4 5)	QTY	APP
–		N		**200** EXAMINATION ARM	PL	A
–		N		**200** EXAMINATION ARM	PL	B
1	2196884	2		• PADDLE CASTING	1	A,B
2	91513131	1		• BALL– LATCH	1	A,B
3	2135377	1		• ENCODER WHEEL ASSEMBLY	1	A,B
4	2137917	1		• ENCODER KNOB ASSEMBLY	1	A,B
5	2119388	1		• **200PL6** MAGNIFICATION BOARD	1	B
6	91280699	2		• BALL BEARING 6X19X6 1–ROW	2	A,B
7	2147039	1		• MAGNET ASSEMBLY	1	A,B
– 8		N		• • SUPPORT	1	A,B
– 9		N		• • MAGNET	1	A,B
10	2135281	1		• COMPRESSION MOTOR ASSEMBLY	1	A,B
– 11		N		• • SUPPORT MOTORISATION	1	A,B
– 12		N		• • W200 WIRED COMPRESSION MOTOR	1	A,B
– 13		N		• • MOTOR PULLEY	1	A,B
– 14		N		• • TIMING BELT L=225	1	A,B
– 15		N		• • TOOTHED PULLEY	1	A,B
– 16		N		• • BEARING	1	A,B
– 17	2208384	2		• COMPRESSION CARRIAGE ASSEMBLY	1	A,B

RENEWAL PARTS

ILLUSTRATION 5–16
200 EXAMINATION ARM 2147433
200 EXAMINATION ARM 2140057



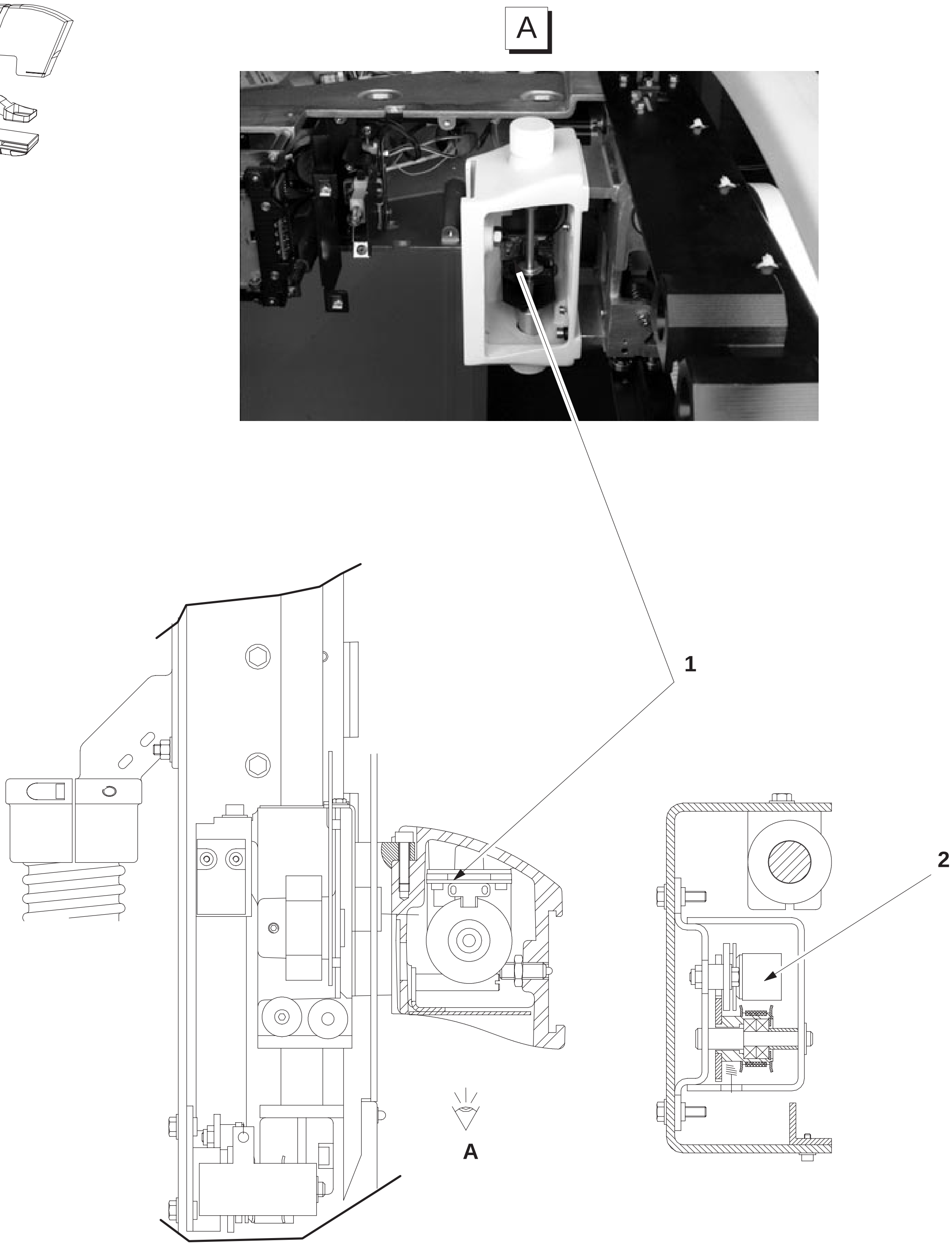
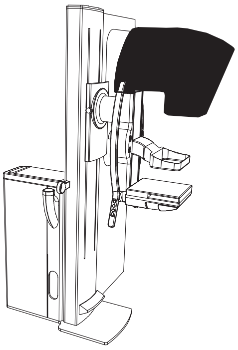
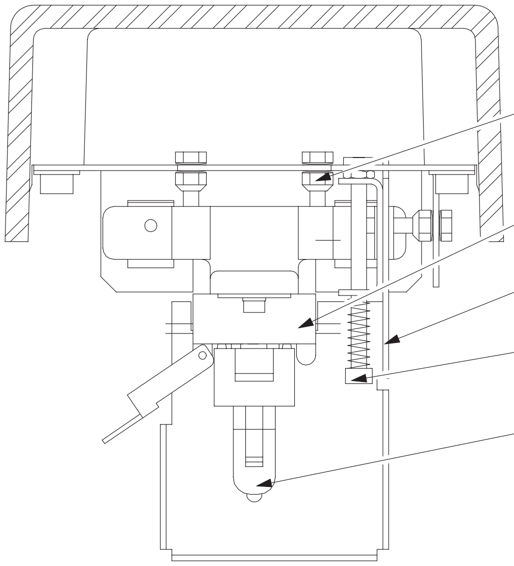


ILLUSTRATION 5–16
200 EXAMINATION ARM 2147433
200 EXAMINATION ARM 2140057

ITEM NO.	PART NO.	FRU	REP	DESCRIPTION 1 2 3 4 5	QTY	APP
–		N		**200** EXAMINATION ARM	PL	A
–		N		**200** EXAMINATION ARM	PL	B
1	2148752	1		• **200PL8** ENCODER BOARD	1	A,B
2	2135290	1		• THICKNESS POTENTIOMETER ASSEMBLY	1	B
– 3		N		• • W209 THICKNESS POTENTIOMETER	1	B
– 4		N		• • PINION, 40–TOOTH	1	B
– 5		N		• • FRONT FLANGE	1	B
– 6		N		• • POTENTIOMETER FLANGE	1	B
– 7		N		• • COMPRESSION SPRING	1	B

ILLUSTRATION 5–17
200 TUBE HOUSING SPACER





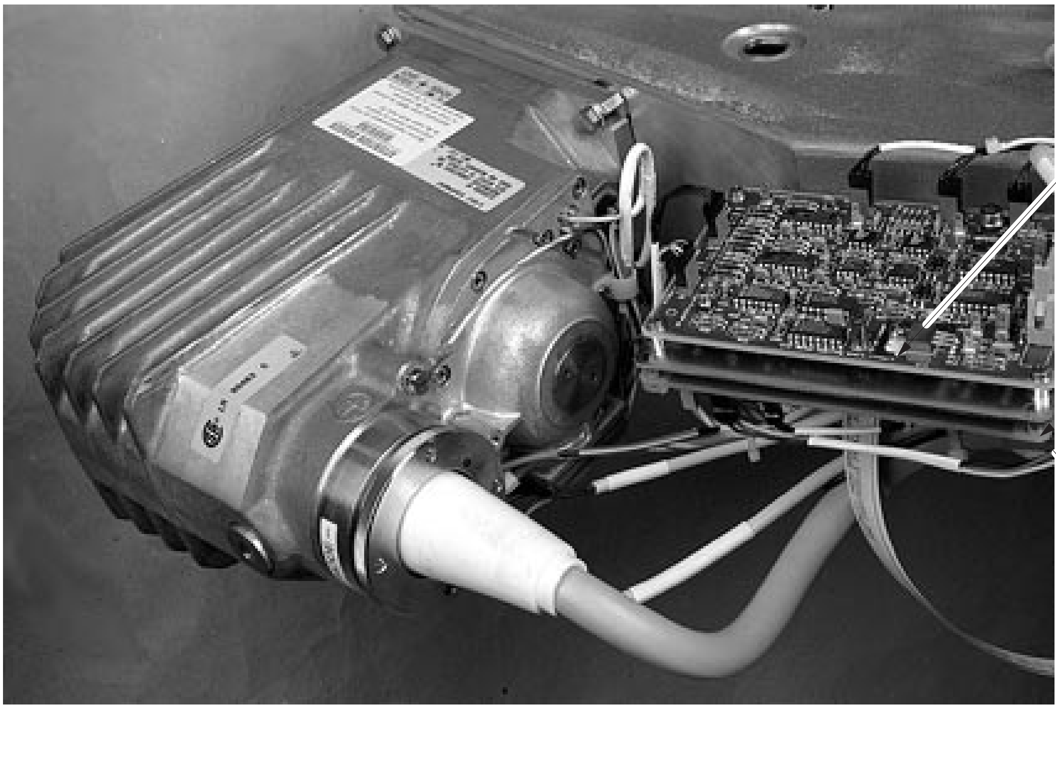


ILLUSTRATION 5–17
200 TUBE HOUSING SPACER

ITEM NO.	PART NO.	FRU	REP	DESCRIPTION 1 2 3 4 5	QTY	APP
–		N		**200** TUBE HOUSING SPACER	PL	A,B
1	2124274	1		• WIRED LAMP SOCKET	1	A,B
2	2188569	1		• HALOGEN LAMP 12V 100W	1	A,B
3	2120924–2	1		• **200PL9** ARM_2 DISTRIBUTION BOARD	1	A,B
4	2111929	1		• **200PL1** ARM_1 DISTRIBUTION BOARD	1	A,B
5	2185793	2		• DEFLECTOR ASSEMBLY	1	A,B
6		N		• • DEFLECTOR	1	A,B
7		N		• • SPRING COMPRESSION 16 MM	1	A,B
8		N		• • SCREW HEXAGON SOCKET 4 MM	1	A,B
9		N		• • ANCHOR NUT M4	1	A,B

RENEWAL PARTS

ILLUSTRATION 5–18
200 TUBE HOUSING SPACER

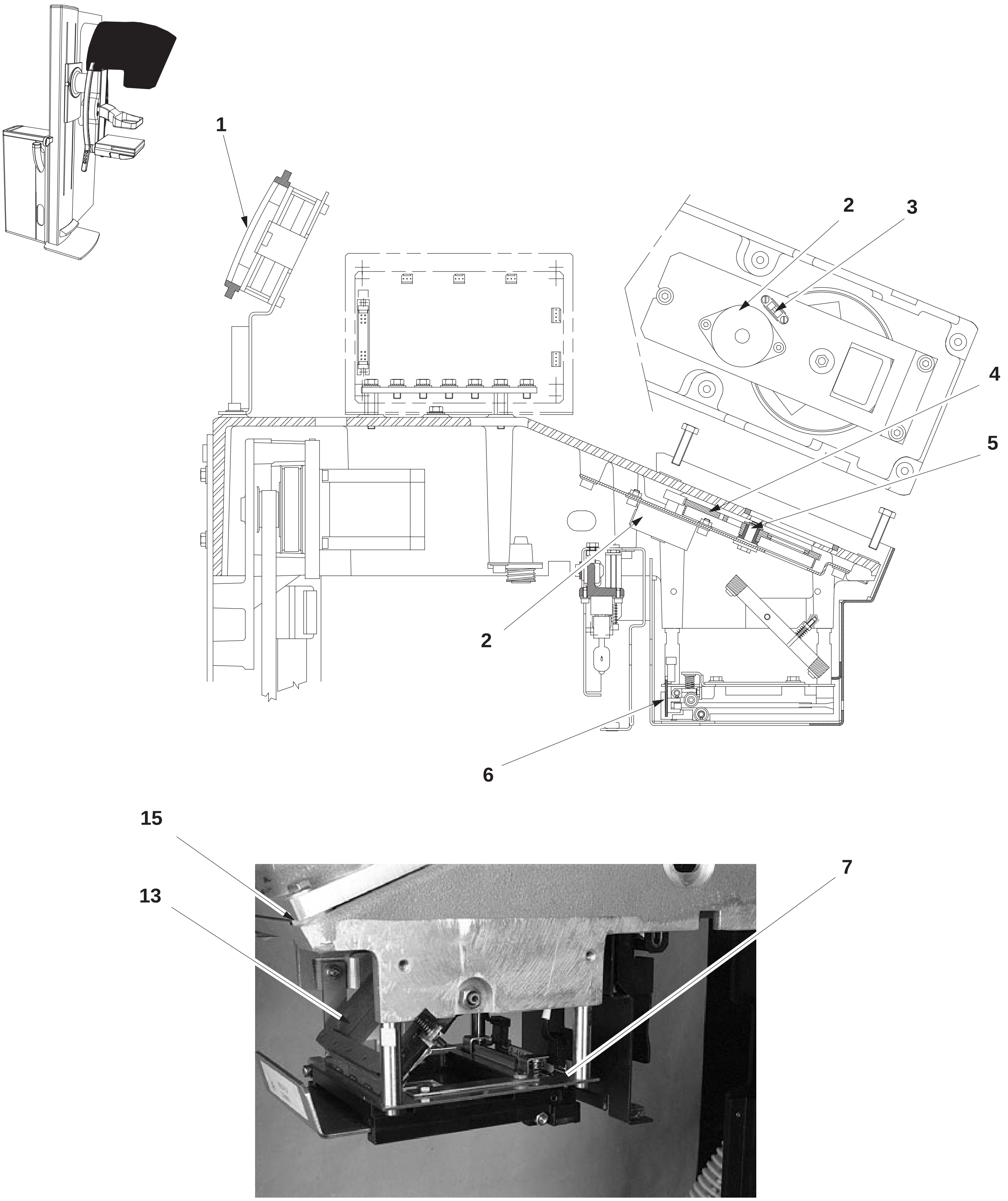
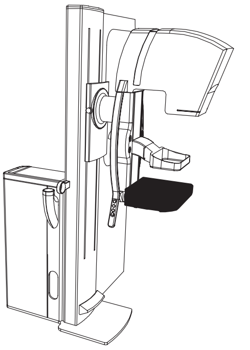


ILLUSTRATION 5–18
200 TUBE HOUSING SPACER

ITEM NO.	PART NO.	FRU	REP	DESCRIPTION 1 2 3 4 5	QTY	APP
–		N		**200** TUBE HOUSING SPACER	PL	A,B
1	2124276	1		• WIRED TUBE COOLING FAN	1	A,B
2	2132871	1		• WIRED FILTER MOTOR	1	B
3	2132870	1		• WIRED FILTER POSITION CELL	1	B
4	45560092	1		• FILTER WHEEL	1	B
5	91307501	1		• FILTER WHEEL CLIP	1	B
6	2111933	1		• **200PL2** COLLIMATOR DETECTION BOARD	4	A,B
7	2142668	1		• FRAME COLLIMATOR HOLDER ASSEMBLY	1	A,B
– 8		N		• • DIAFRAGM SUPPORT	1	A,B
– 9	2147504	1		• FILTER ASSEMBLY (MO)	1	A
– 10		N		• • FILTER SUPPORT, MOLYBDENUM	1	A
– 11		N		• • RING	1	A
– 12		N		• • MO FILTER	1	A
13	2142669	1		• MIRROR ASSEMBLY	1	A,B
– 14		N		• • MIRROR, MACHINED	1	A,B
15	2114507	1		• NYLON NUT SCREW FOR FIXING X-RAY TUBE HOUSING	4	A,B

RENEWAL PARTS

ILLUSTRATION 5–19
200 IMAGE RECEPTOR



THE SWITCH (NEEDDLE) U14 ON 200PL3 MUST BE OPENED IN “APPLICATION MODE”

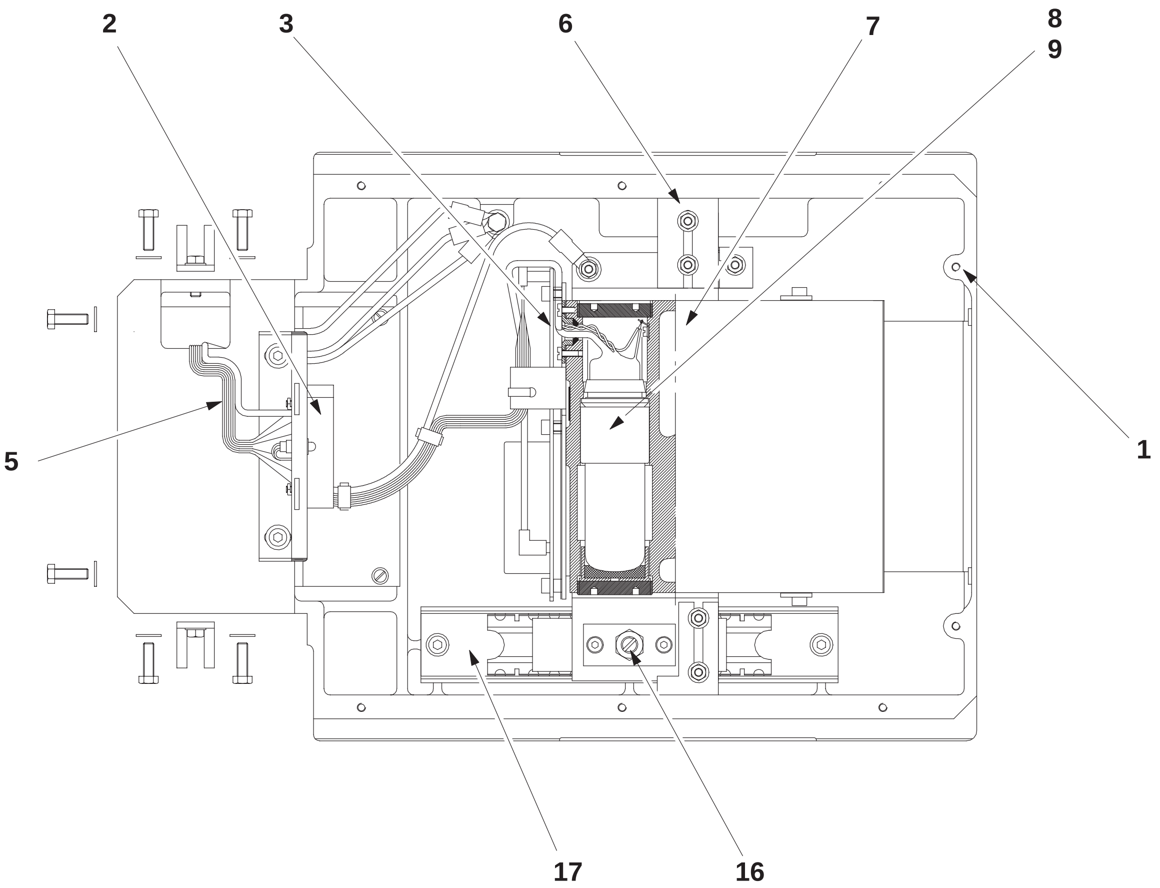
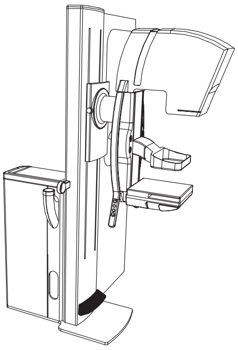


ILLUSTRATION 5–19
200 IMAGE RECEPTOR

ITEM NO.	PART NO.	FRU	REP	DESCRIPTION 1 2 3 4 5	QTY	APP
–		N		**200** IMAGE RECEPTOR	PL	A,B
1	2111736	2		• IMAGE RECEPTOR CASTING	1	A,B
2	2136642	1		• WIRED LED PANEL MOUNT INDICATOR	1	A,B
3	2111931–3	1		• **200PL5** HTPM BOARD	1	A,B
4	2133171–2	1		• **200PL3** BUCKY COMMAND BOARD	1	A,B
5	2124360	2		• W226 CABLE FROM XJ2 200PL3 TO 200PL10	2	A,B
6	2189886	2		• CELL BUTTONS REPLACEMENT	2	A,B
7	2143053	1	Y	• PHOTOMULTIPLIER CELL ASSEMBLY	1	A,B
8	2143783	1		• • KIT PHOTOMULTIPLIER	1	A,B
9	45067100	1		• • • PHOTOMULTIPLIER TUBE	1	A,B
–		N		• • • TUBE GUIDE	1	A,B
–		N		• • • STOPPER	1	A,B
–		N		• • • PLUG	1	A,B
–		N		• • • SN 4085–SENO, PMT REPLACEMENT	1	A,B
– 10		N		• • CASE	1	A,B
– 11		N		• • SCREEN	1	A,B
– 12		N		• • CABLE SUPPORT	1	A,B
– 13		N		• • W210 CABLE PHOTOMULTIPLIER TUBE	1	A,B
– 14		N		• • W219 CABLE FROM 200PL5 TO PHOT TUBE	1	A,B
– 15		N		• • W220 CABLE FROM CELLULE TO 200PL5	1	A,B
16	91389008	2		• BALL –LATCH	1	A,B
17	2114803	1		• BALL RACE	1	A,B

RENEWAL PARTS

ILLUSTRATION 5–20
READOUT UNIT 2148068



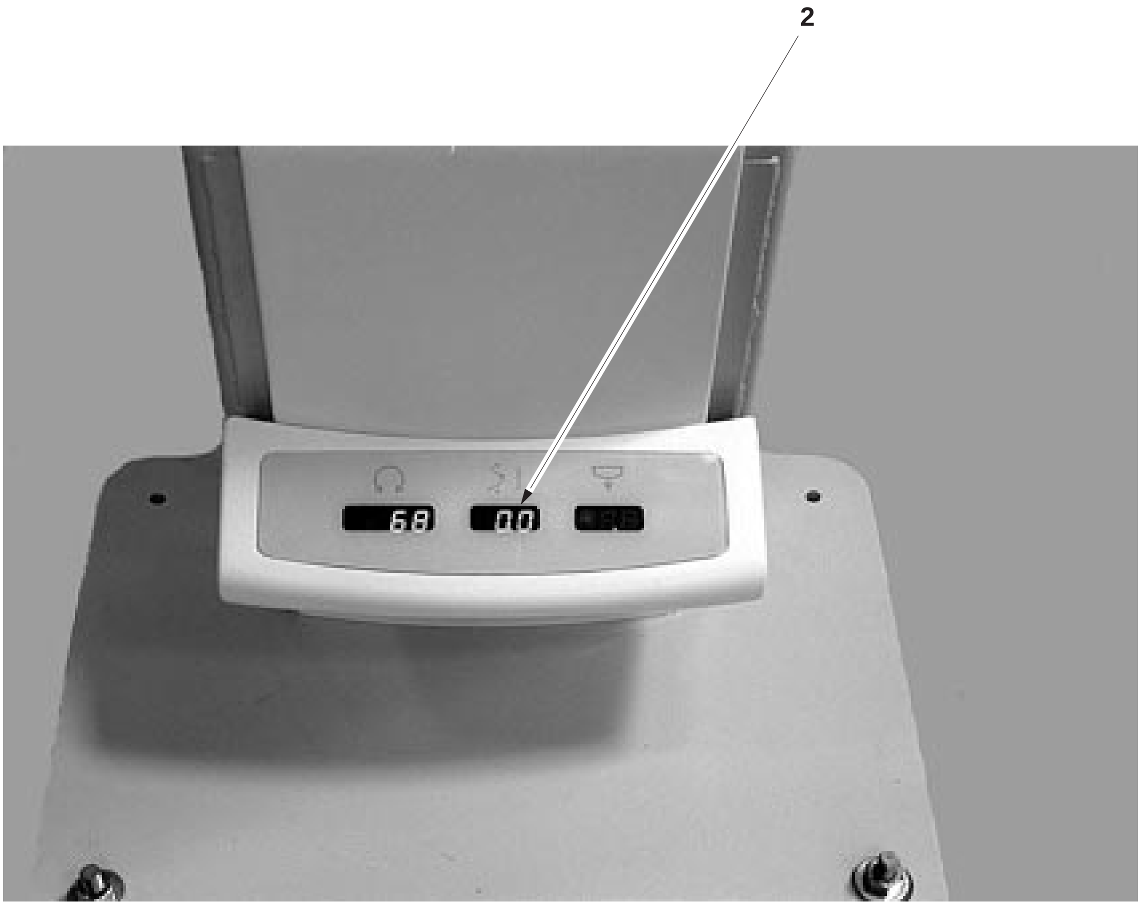


ILLUSTRATION 5–20
READOUT UNIT 2138068

ITEM NO.	PART NO.	FRU	REP	DESCRIPTION 1 2 3 4 5	QTY	APP
–	2138068	1		READOUT UNIT	PL	B
1	2127947–2	1		• • **200PL4** DISPLAY BOARD	1	B

ILLUSTRATION 5–21
100 CONTROL PANEL 2109355

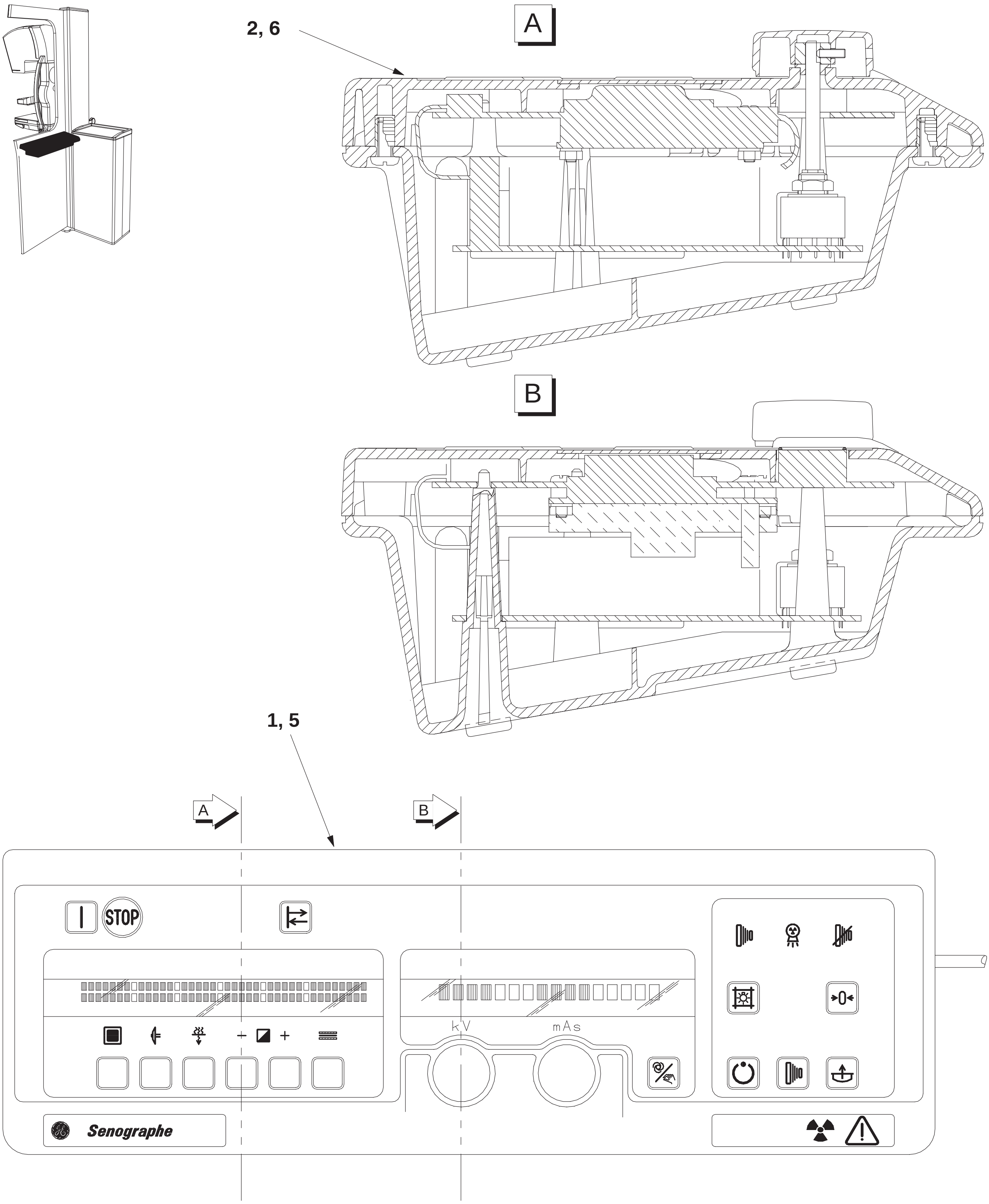


ILLUSTRATION 5–21
100 CONTROL PANEL 2109355

ITEM NO.	PART NO.	FRU	REP	DESCRIPTION 1 2 3 4 5	QTY	APP
1	2235013	1	Y	• **100** NEW CONSOLE CDRH EQUIPPED	1	A,B
– 2	2229050	1		• • CONSOLE COVER		
– 3	2227911	1		• • PUSHBUTTON WITHOUT LIGHT		
– 4	2227912	1		• • PUSHBUTTON WITH LIGHT		
5	2107636	1	Y	• **100** OLD CONSOLE CDRH EQUIPPED		A,B
6	2143061	1		• • CONSOLE COVER ASSEMBLY WITH MYLAR		
– 7	2144969	1		• • PUSHBUTTON KIT (PREP/EXP)		

RENEWAL PARTS

ILLUSTRATION 5–22
COVERS

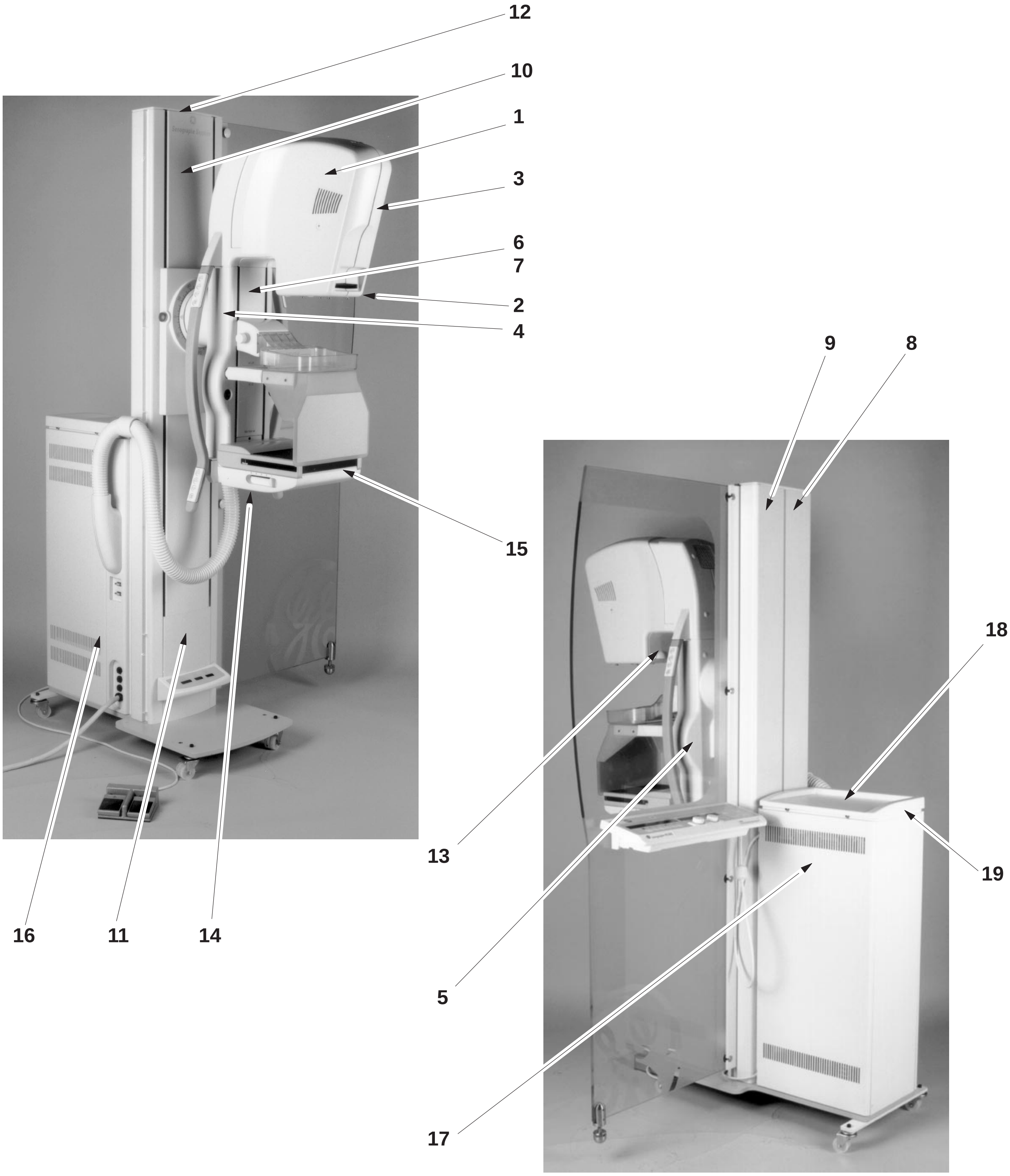
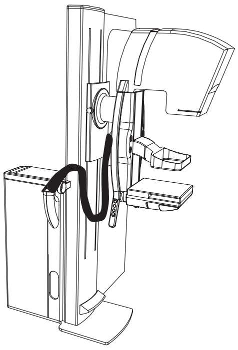


ILLUSTRATION 5–22
COVERS

ITEM NO.	PART NO.	FRU	REP	DESCRIPTION 1 2 3 4 5	QTY	APP
–		N		**COVERS**	PL	A,B
1	2145228	1		• LEFT COVER, TUBE HOUSING SPACER	1	A,B
2	2168756	2		• SHOULDER GUARD FIXATION KIT	1	A,B
3	2145227	1		• RIGHT COVER, TUBE HOUSING SPACER	1	A,B
4	2120610	1		• LEFT COVER, EXAMINATION ARM	1	A,B
5	2120609	1		• RIGHT COVER, EXAMINATION ARM	1	A,B
6	2150119	1		• FRONT COVER, EXAMINATION ARM	1	A
7	2150120	1		• FRONT COVER, EXAMINATION ARM	1	B
8	2116658	2		• LEFT LATERAL COVER, COLUMN	1	A,B
9	2116657	2		• RIGHT LATERAL COVER, COLUMN	1	A,B
10	2177832	2		• FRONT COVER, COLUMN	1	A,B
11	2177833	2		• FRONT BOTTOM COVER, COLUMN	1	A,B
12	2116656	2		• TOP COVER, COLUMN	1	A,B
13	2145229	1		• LAMP ACCESS COVER	1	A,B
14	2117738	1		• BACK COVER, IMAGE RECEPTOR	1	A,B
15	2113437	1		• TOP COVER, IMAGE RECEPTOR	1	A,B
16	2115793	2		• REAR COVER, ELECTRONICS CABINET	1	A,B
17	2115792	2		• FRONT COVER, ELECTRONICS CABINET	1	A,B
18	2179341	1		• TOP COVER, ELECTRONICS CABINET EQUIPPED	1	A,B
19	2147088	2		• RAPID LOCK (MOD R6652 AC–ZN) FOR TOP COVER	2	A,B

ILLUSTRATION 5–23
CONDUIT CABLE 2124272



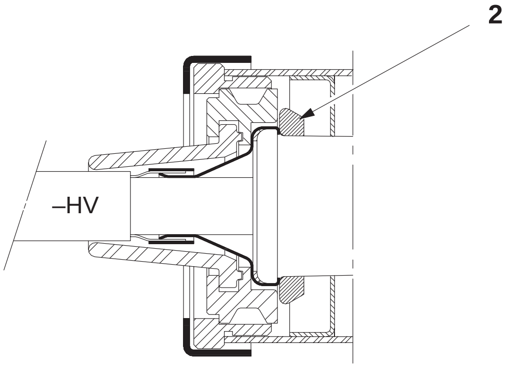


ILLUSTRATION 5–23
CONDUIT CABLE 2124272

ITEM NO.	PART NO.	FRU	REP	DESCRIPTION 1 2 3 4 5	QTY	APP
–	2124272	2		CONDUIT CABLE	PL	A,B
– 1		N		• –HV CABLE	1	A,B
2	C133902	1		• • GASKET	1	A,B

RENEWAL PARTS

ILLUSTRATION 5–24
ACCESSORIES

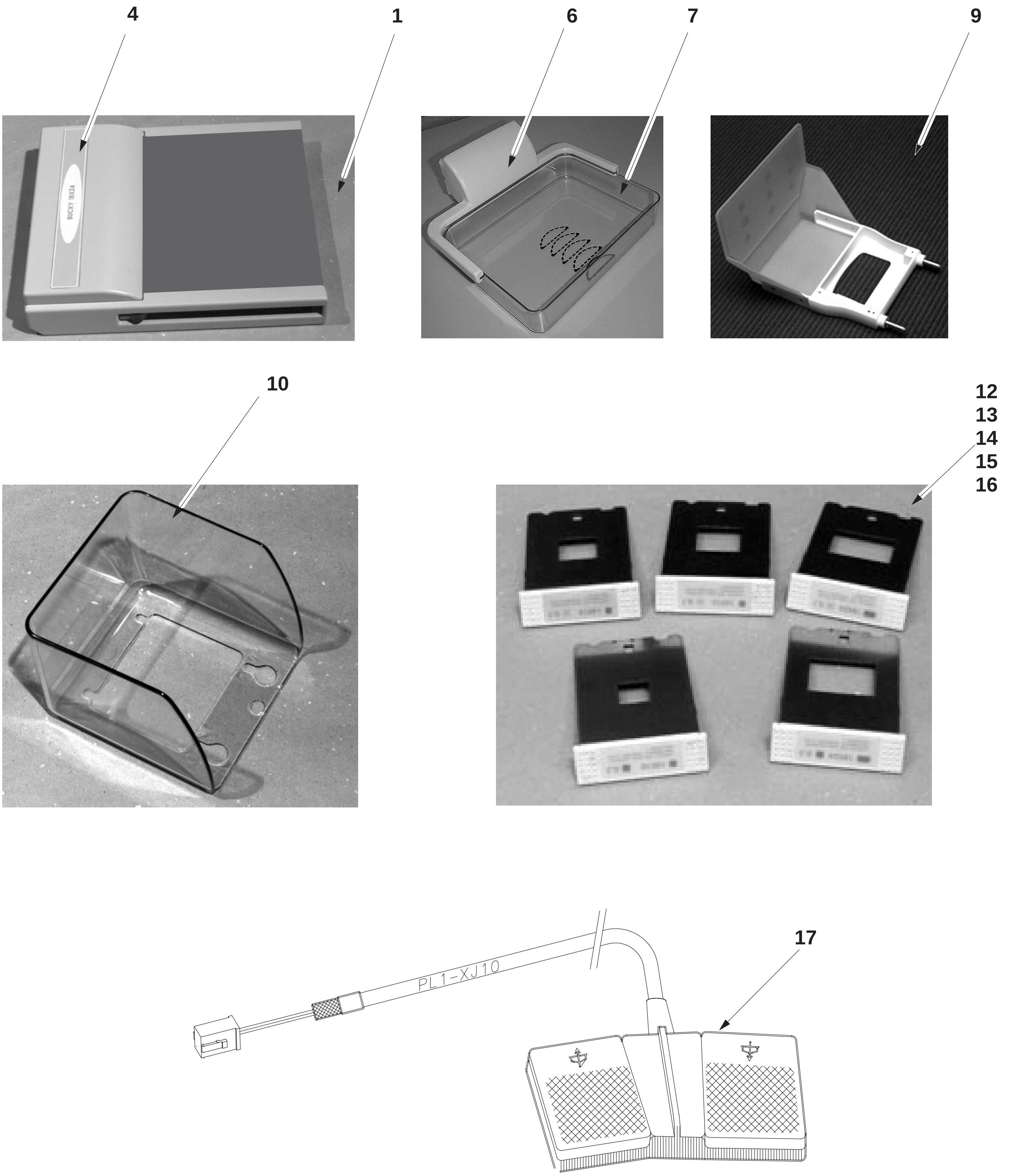
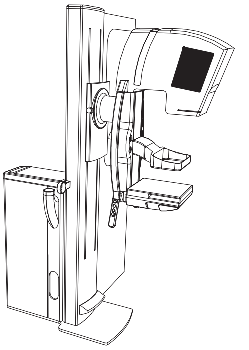


ILLUSTRATION 5–24
ACCESSORIES

ITEM NO.	PART NO.	FRU	REP	DESCRIPTION 1 2 3 4 5	QTY	APP
–		N		ACCESSORIES	PL	A,B
1	2142957	1	Y	• 18X24 BUCKY CDRH	1	A,B
– 2	2113936	1		• • GRID 18X24	1	A,B
– 3	2179508	2		• • 18X24 BUCKY TOP TRANSPARENT COVER	1	A,B
– 4	2191273	2		• • TOP COVER EQUIPPED, BUCKY 18 X 24	1	A,B
– 5	2174361	1		• CASSETTE HOLDER WITHOUT COVER	1	A,B
6	2233355–2	1		• 18X24 COMPLETE COMPRESSION PADDLE	1	A,B
7	2236987	1		• • COMPRESSION PLASTIC PLATE	1	A,B
– 8	45475446	1		• SQUARE SPOT INJECTED COMPRESSION PADDLE	1	A,B
9	2142952	2		• MAGNIFICATION STAND CDRH	1	A,B
–	91671876	2		• MAGNET D = 4 X 20	1	A,B
10	2121396	1		• SHOULDER GUARD	1	A,B
– 11	2168756	2		• SHOULDER GUARD FIXATION KIT	1	A,B
12	2142674	2		• 18X24 LARGE FOCUS BLADE	1	A,B
13	2142673	2		• 18X24 SMALL FOCUS BLADE	1	A,B
14	2165417	2		• SQUARE SPOT LARGE FOCUS CONTACT BLADE	1	A,B
15	2165418	2		• SQUARE SPOT SMALL FOCUS 1ST MAG FACTOR BLADE	1	A,B
16	2165419	2		• SQUARE SPOT SMALL FOCUS 2ND MAG FACTOR BLADE	1	A,B
17	2235874	1		• COMP/DECOMP FOOTSWITCHES EMC	1	A,B
–	2162958	2		• MANUAL FILM MARKING DEVICE	1	A,B
–	2140154	2		• MAINS SUPPLY CABLE	1	A,B
–	2147528	1		• SERVICE TERMINAL CABLE	1	A,B

RENEWAL PARTS

ILLUSTRATION 5–25
X–RAY TUBE ASSEMBLY, MAXIRAY 70 TH–M 2133635



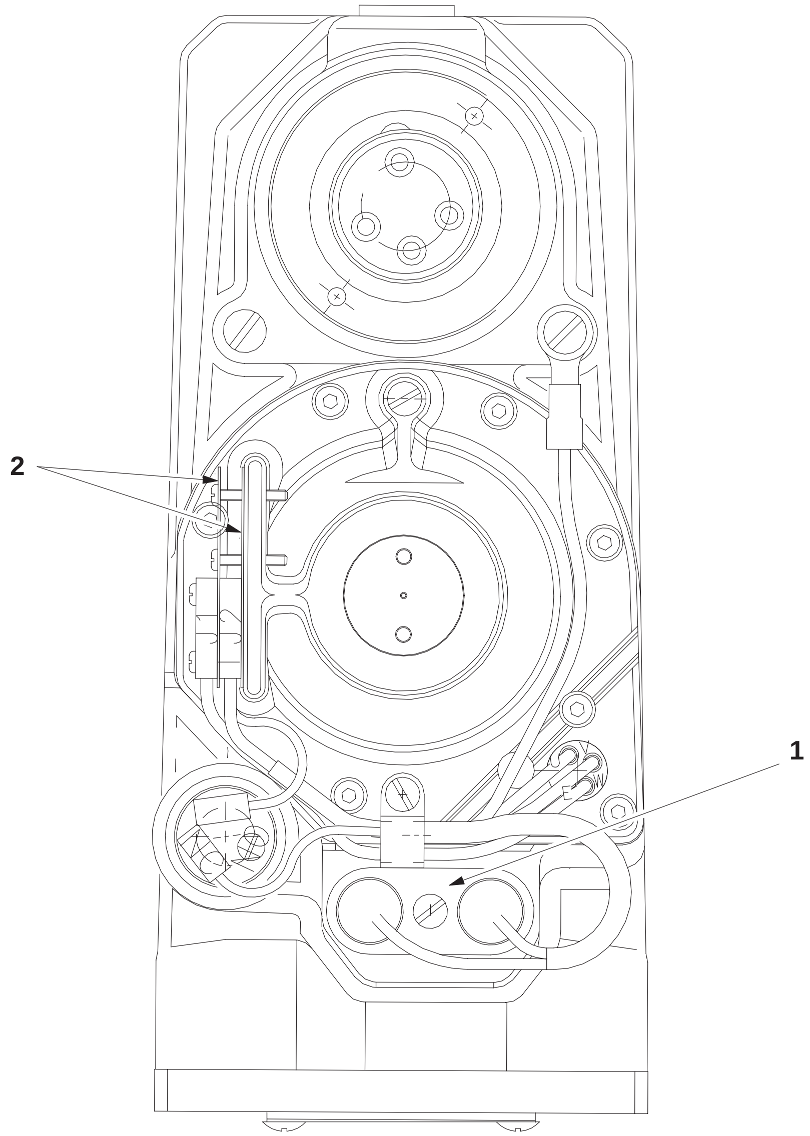
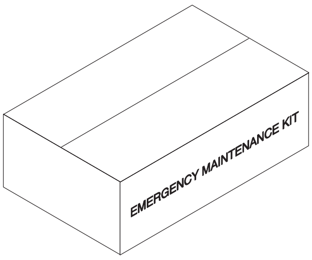


ILLUSTRATION 5–25
X–RAY TUBE ASSEMBLY, MAXIRAY 70 TH–M 2133635

ITEM NO.	PART NO.	FRU	REP	DESCRIPTION 1 2 3 4 5	QTY	APP
–	2133635	1		X–RAY TUBE ASSEMBLY, MAXIRAY 70 TH–M	PL	A,B
1	2105128	1		• THERMOSTATS + HARNESS	1	A,B
2	2105127	2		• INSULATING PLATE	2	A,B

RENEWAL PARTS

ILLUSTRATION 5–26
EMERGENCY MAINTENANCE KIT 2143982



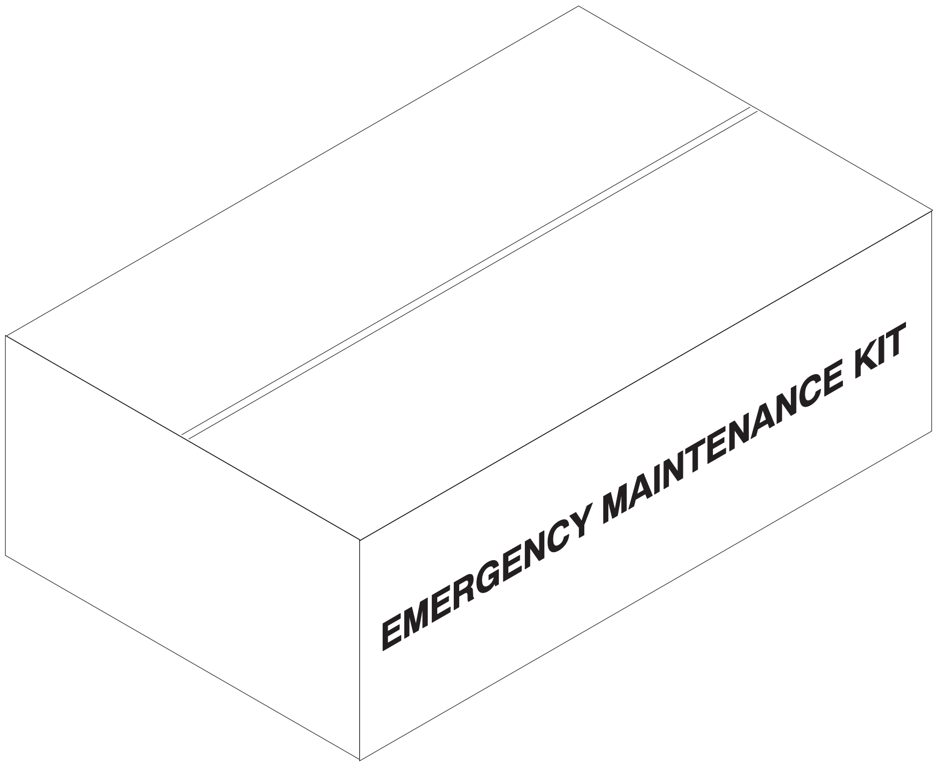
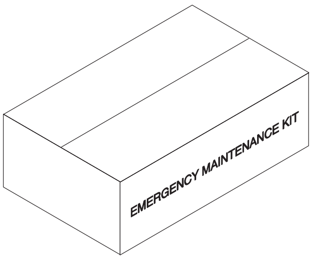
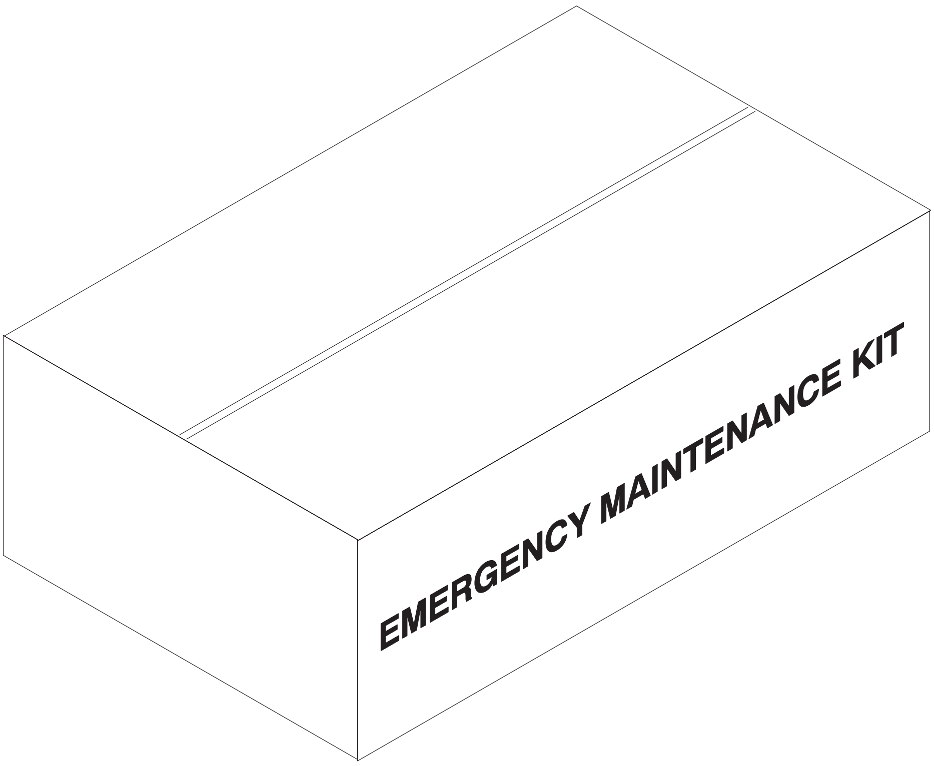


ILLUSTRATION 5–26
EMERGENCY MAINTENANCE KIT 2143982

ITEM NO.	PART NO.	FRU	REP	DESCRIPTION 1 2 3 4 5	QTY	APP
–	2143982	2		EMERGENCY MAINTENANCE KIT	PL	A,B
– 1		N		• SHAFT	2	A,B
– 2		N		• CS SCREW, M4X16	2	A,B
– 3		N		• SCREW, LRG RAISED RND HD M4X10	2	A,B
– 4		N		• WASHER, FLAT Z4N	2	A,B
– 5		N		• SCREW, HEX SKT HD CAP M5X50	1	A,B
– 6		N		• SCREW, HEX SKT HD CAP M4X8	2	A,B
– 7		N		• CS SCREW, M4X8	1	A,B
– 8		N		• CAP, D=8	1	A,B
– 9		N		• CAP, D=14	10	A,B
– 10		N		• CAP, BASE PLATE, D=12	6	A,B
– 11		N		• FAST FUSE, 10X38 25A 600V ULL	2	A,B
– 12		N		• SLOW–BLOW FUSE, 6X32 3.2A 250V ULL	4	A,B
– 13		N		• FAST FUSE 10X38 5A 660V 160KA ULR	1	A,B
– 14		N		• FAST FUSE 10X38 10A 660V 160KA ULR	1	A,B
– 15		N		• SLOW–BLOW FUSE 5X20 3.15A 250V V 35A ULR	1	A,B
– 16		N		• SLOW–BLOW FUSE, 6X32 1.0A 250V	1	A,B
– 17		N		• SLOW–BLOW FUSE, 6X32 2.0A 250V ULL	1	A,B
– 18		N		• SLOW–BLOW FUSE, 6X32 10.0A 250V ULL	4	A,B
– 19		N		• FAST FUSE, 6X32 2.0A 250V ULL	1	A,B
– 20		N		• FAST FUSE, 6X32 3.0A 250V ULL	1	A,B
– 21		N		• FAST FUSE, 6X32 0.3A 250V ULL	1	A,B
– 22		N		• FAST FUSE, 6X32 8A 250V ULL	5	A,B
– 23		N		• SLOW–BLOW FUSE 5X20 3.15A 250V C 1500A CEI	1	A,B
– 24		N		• BAG OF LANGUAGE STICK–ON LABELS	1	A,B
– 25		N		• CABLE TIE		A,B
– 26		N		• TOOL		A,B

ILLUSTRATION **5–26**
EMERGENCY MAINTENANC EKIT 2143982 (Continued)





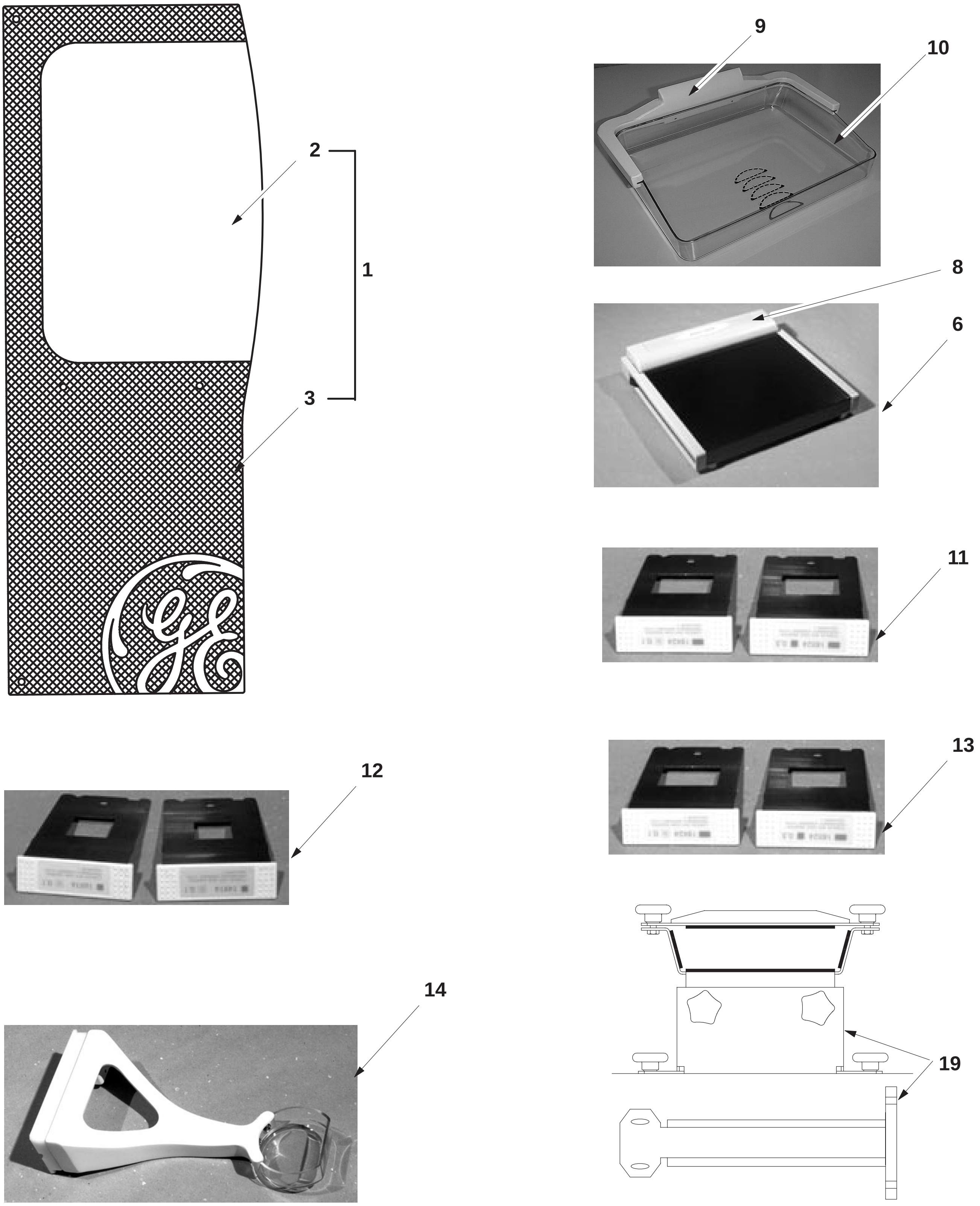
RENEWAL PARTS

ILLUSTRATION 5–26
EMERGENCY MAINTENANCE KIT (Continued.)

ITEM NO.	PART NO.	FRU	REP	DESCRIPTION (1 2 3 4 5)	QTY	APP
– 27	99060937	N		• SCREW, HEX SKT HD CAP M3X10		A,B
– 28	99077775	N		• WASHER, FLAT M3		A,B
– 29	99110714	N		• SCREW, SLTD HD COUNTERSUNK 90° M3X6		A,B

RENEWAL PARTS

ILLUSTRATION 5–27
OPTIONAL ACCESSORIES



RENEWAL PARTS

ILLUSTRATION 5–27
OPTIONAL ACCESSORIES

ITEM NO.	PART NO.	FRU	REP	DESCRIPTION 1 2 3 4 5	QTY	APP
–		N		OPTIONAL ACCESSORIES	PL	A,B
1	2122185	2		• BASIC X-RAY PROTECTIVE SHIELD (GLASS + SHIELD HOLDER ASSEMBLY)	1	A,B
2	2146367	1		• PROTECTIVE GLASS (ONLY GLASS)	1	A,B
3	2151762	2		• SHIELD HOLDER ASSEMBLY	1	A,B
– 4	2150064	1		• LONG CONTROL PANEL CABLE (10M)	1	A,B
– 5	2122186	1		• CONTROL PANEL HOLDER & LONG CABLE (10M) (FOR JAPAN)	1	A,B
6	2142977	1	Y	• 24X30 BUCKY CDRH	1	A,B
– 7	2113937	1		• • 24X30 GRID	1	A,B
8	2191274	2		• • TOP COVER EQUIPPED, BUCKY 24 X 30	1	A,B
9	2244710–2	1		• 24X30 COMPLETE COMPRESSION PADDLE	1	A,B
10	2244716	1		• • 24X30 COMPRESSION PLASTIC PLATE	1	A,B
11	2175102	2		• SET OF 24X30 COLLIMATOR BLADES: LF & SF	1	A,B
–		N		• • 24X30 LARGE FOCUS BLADE	1	A,B
–		N		• • 24X30 SMALL FOCUS BLADE	1	A,B
12	2214506	2		• SET OF 18X24 COLLIMATOR BLADES: LF & SF (FOR UK)	1	A,B
–		N		• • 18X24 LARGE FOCUS BLADE (FOR UK)	1	A,B
–		N		• • 18X24 SMALL FOCUS BLADE (FOR UK)	1	A,B
13	2214505	2		• SET OF 24X30 COLLIMATOR BLADES: LF & SF (FOR UK)	1	A,B
–		N		• • 24X30 LARGE FOCUS BLADE (FOR UK)	1	A,B
–		N		• • 24X30 LARGE FOCUS BLADE (FOR UK)	1	A,B
14	2102380	1		• SMALL ROUND SPOT COMPRESSION PADDLE	1	A,B
– 15	C323051	1		• • PLASTIC PART FOR SMALL ROUND SPOT COMPRESSION PADDLE	1	A,B
– 16	2165531	2		• SET OF SMALL ROUND COLL BLADES: LF CONTACT, SF 1ST & 2ND F.	1	A,B
–		N		• • DIAP. ROUND 1.5 SMALL FOCUS CDRH	1	A,B
–		N		• • DIAP. ROUND 1.8 SMALL FOCUS CDRH	1	A,B
–		N		• • DIAP. ROUND 1 LARGE FOCUS CDRH	1	A,B

RENEWAL PARTS

ILLUSTRATION **5–27**
OPTIONAL ACCESSORIES (Continued)

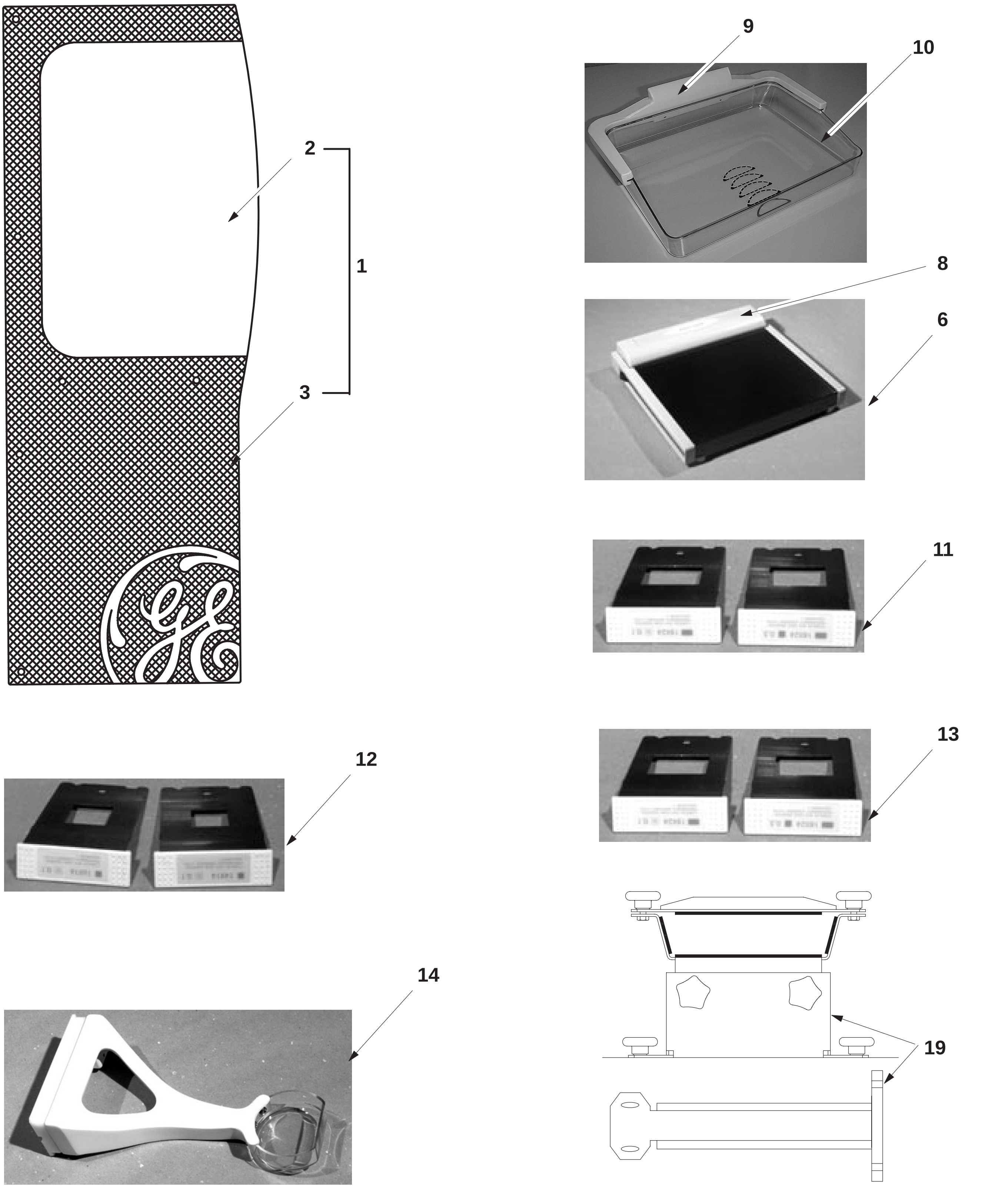


ILLUSTRATION 5–27
OPTIONAL ACCESSORIES (Continued)

ITEM NO.	PART NO.	FRU	REP	DESCRIPTION 1 2 3 4 5	QTY	APP
– 17	2148861	1		• 18X24 AXILLARY COMPRESSION PADDLE	1	A,B
– 18	2148862	1		• PLASTIC PART FOR AXILLARY COMPRESSION PADDLE	1	A,B
19	2122201	2		• TRUCK KIT	1	A,B
				FLIPPING MARKERS WITH RODS AND SNAPS		
– 20	2249212	1		• MARKERS INSTALLATION KIT (S 30321KP)	1	A,B
– 21	2249214	1		• SET OF BUCKY COVERS 700/800T (S 30321LC)	1	A,B
– 22	2255829	1		• • COVER TOP REAR BUCKY 18 X 24	1	A,B
– 23	2255831	1		• • COVER TOP REAR BUCKY 24 X 30	1	A,B
– 24	2242700	2		• SET OF 9 MARKERS ENGLISH (S 30321DM)	1	A,B
– 25	2242702	2		• SET OF 9 MARKERS GERMAN (S 30321DP)	1	A,B
– 26	2242701	2		• SET OF 9 MARKERS FRENCH (S 30321DN)	1	A,B
– 27	2242703	2		• SET OF 9 MARKERS SPANISH (S 30321DR)	1	A,B
– 28	2249211	2		• SET OF 9 MARKERS ITALIAN (S 30321KN)	1	A,B
– 29	2262563	2		• SET OF 9 MARKERS PORTUGUESE (S 30321KG)	1	A,B
– 30	2242704	2		• ADITIONAL SET OF 20 MARKERS IN ENGLISH (S 30321DS)	1	A,B
				OLD MARKERS WITH SUCTION CUPS		
– 31	E02561DC	1		• SET OF 6 LANGUAGE MARKERS	1	A,B
– 32	2164645	1		• ADDITIONAL SET OF MARKERS	1	A,B

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CHAPTER 6 – SIGNAL NAME

SIGNAL NAME	WIRING	FROM	TO
0V/GND	W1	300PL5 J12–1	300PL1 J1–1
0V/GND	W1	300PL5 J12–10	300PL1 J1–10
0V/GND	W1	300PL5 J12–33	300PL1 J1–33
0V/GND	W1	300PL5 J12–34	300PL1 J1–34
FOOT_SW_PRES	W1	300PL1 J1–2	300PL5 J12–2
COMP_ON	W1	300PL5 J12–3	300PL1 J1–3
FOOT_SW_COMP	W1	300PL1 J1–4	300PL5 J12–4
ELEV_ON	W1	300PL5 J12–5	300PL1 J1–5
FOOT_SW_DECOMP	W1	300PL1 J1–6	300PL5 J12–6
COMP_STATE_OFF	W1	300PL1 J1–7	300PL5 J12–7
ELEV_STATE_OFF	W1	300PL1 J1–8	300PL5 J12–8
NC	W1	300PL1 J1–9	300PL5 J12–9
PWM_COMP1–	W1	300PL5 J12–11	300PL1 J1–11
PWM_COMP1+	W1	300PL5 J12–12	300PL1 J1–12
+5V VCC	W1	300PL5 J12–13	300PL1 J1–13
+5V VCC	W1	300PL5 J12–14	300PL1 J1–14
+5V VCC	W1	300PL5 J12–21	300PL1 J1–21
+5V VCC	W1	300PL5 J12–22	300PL1 J1–22
PWM_COMP2–	W1	300PL5 J12–15	300PL1 J1–15
PWM_COMP2+	W1	300PL5 J12–16	300PL1 J1–16
+15V/+15VF	W1	300PL5 J12–17	300PL1 J1–17
+15V/+15VF	W1	300PL5 J12–18	300PL1 J1–18
PWM_ELEV–	W1	300PL5 J12–19	300PL1 J1–19
PWM_ELEV+	W1	300PL5 J12–20	300PL1 J1–20
CEMF_ELEV–	W1	300PL1 J1–23	300PL5 J12–23
CEMF_ELEV+	W1	300PL1 J1–24	300PL5 J12–24
–15V/–15VF	W1	300PL5 J12–25	300PL1 J1–25

SIGNALS NAMES

SIGNAL NAME	WIRING	FROM	TO
–15V/–15VF	W1	300PL5 J12–26	300PL1 J1–26
MOT_COMP2	W1	300PL5 J12–27	300PL1 J1–27
MOT_COMP1	W1	300PL5 J12–28	300PL1 J1–28
ELEV_L_STOP	W1	300PL1 J1–29	300PL5 J12–29
ELEV_H_STOP	W1	300PL1 J1–30	300PL5 J12–30
ELEV_SECURITY	W1	300PL1 J1–31	300PL5 J12–31
NC	W1	300PL1 J1–32	300PL5 J12–32
0V/GND	W2	300PL5 J10–1	300PL2 J1–1
0V/GND	W2	300PL5 J10–3	300PL2 J1–3
0V/GND	W2	300PL5 J10–5	300PL2 J1–5
0V/GND	W2	300PL5 J10–16	300PL2 J1–16
30V/30V STATIF	W2	300PL2 J1–7	300PL5 J10–7
30V/30V STATIF	W2	300PL2 J1–9	300PL5 J10–9
30V/30V STATIF	W2	300PL2 J1–11	300PL5 J10–11
+15V/+15VF	W2	300PL5 J10–10	300PL2 J1–10
–15V/–15VF	W2	300PL5 J10–13	300PL2 J1–13
+5V VCC	W2	300PL5 J10–12	300PL2 J1–12
ROT_ON	W2	300PL5 J10–2	300PL2 J1–2
LIGHT_ON	W2	300PL5 J10–4	300PL2 J1–4
ROT_STAT_OFF	W2	300PL2 J1–6	300PL5 J10–6
LIGHT_FAIL	W2	300PL2 J1–8	300PL5 J10–8
NC	W2	300PL2 J1–14	300PL5 J10–14
NC	W2	300PL2 J1–15	300PL5 J10–15
+5V VCC	W3	300PL5 J13–3	300PL3 J1–3
+5V VCC	W3	300PL5 J13–5	300PL3 J1–5
0V/GND	W3	300PL5 J13–1	300PL3 J1–1
0V/GND	W3	300PL5 J13–7	300PL3 J1–7
0V/GND	W3	300PL5 J13–9	300PL3 J1–9
PDD_TX	W3	300PL5 J13–2	300PL3 J1–2
PDD_RX	W3	300PL3 J1–4	300PL5 J13–4

SIGNAL NAME	WIRING	FROM	TO
LAPTOP_TX	W3	300PL5 J13–6	300PL3 J1–6
LAPTOP_RX	W3	300PL3 J1–8	300PL5 J13–8
EVENT_COUNT	W3	300PL5 J13–10	300PL3 J1–10
_TRACK_2	W4	300PL5 J3–19	300PL6 J2–19
BIAS_FREQ+	W4	300PL5 J3–24	300PL6 J2–24
BIAS_FREQ–	W4	300PL5 J3–23	300PL6 J2–23
BIAS_ON	W4	300PL5 J3–26	300PL6 J2–26
HEAT_ON	W4	300PL5 J3–20	300PL6 J2–20
BIAS_OK	W4	300PL6 J2–27	300PL5 J3–27
HEAT_OK	W4	300PL6 J2–21	300PL5 J3–21
HEAT_LOAD+	W4	300PL5 J3–16	300PL6 J2–16
HEAT_LOAD–	W4	300PL5 J3–17	300PL6 J2–17
SRI_HEAT+	W4	300PL5 J3–10	300PL6 J2–10
SRI_HEAT–	W4	300PL5 J3–11	300PL6 J2–11
HEAT_STROBE+	W4	300PL5 J3–14	300PL6 J2–14
HEAT_STROBE–	W4	300PL5 J3–13	300PL6 J2–13
0V/GND	W4	300PL5 J3–1	300PL6 J2–1
0V/GND	W4	300PL5 J3–9	300PL6 J2–9
0V/GND	W4	300PL5 J3–12	300PL6 J2–12
0V/GND	W4	300PL5 J3–15	300PL6 J2–15
0V/GND	W4	300PL5 J3–18	300PL6 J2–18
0V/GND	W4	300PL5 J3–22	300PL6 J2–22
0V/GND	W4	300PL5 J3–25	300PL6 J2–25
0V/GND	W4	300PL5 J3–31	300PL6 J2–31
0V/GND	W4	300PL5 J3–34	300PL6 J2–34
0V/GND	W4	300PL5 J3–44	300PL6 J2–44
CONT_TX+	W4	300PL6 J2–30	300PL5 J3–30
CONT_TX–	W4	300PL6 J2–29	300PL5 J3–29
CONT_RX+	W4	300PL5 J3–32	300PL6 J2–32
CONT_RX–	W4	300PL5 J3–33	300PL6 J2–33

SIGNAL NAME	WIRING	FROM	TO
COMMON_SW	W4	300PL5 J3–38	300PL6 J2–38
PREPA_SW_IN	W4	300PL6 J2–36	300PL5 J3–36
GRAPHY_SW_IN	W4	300PL6 J2–37	300PL5 J3–37
EMERGENCY_SW1	W4	300PL5 J3–39	300PL6 J2–39
EMERGENCY_SW3	W4	300PL6 J2–40	300PL5 J3–40
_LVPS_OK	W4	300PL6 J2–43	300PL5 J3–43
DC_BUS_OK	W4	300PL6 J2–42	300PL5 J3–42
MAINS_OK	W4	300PL6 J2–41	300PL5 J3–41
STARTER_OK	W4	300PL6 J2–3	300PL5 J3–3
_STARTER_ACCEL	W4	300PL6 J2–5	300PL5 J3–5
_STARTER_PRES	W4	300PL6 J2–4	300PL5 J3–4
STARTER_ON	W4	300PL5 J3–2	300PL6 J2–2
STARTER_SPEED	W4	300PL6 J2–6	300PL5 J3–6
BRAKE_STARTER	W4	300PL5 J3–8	300PL6 J2–8
MAINT_STARTER	W4	300PL5 J3–7	300PL6 J2–7
EXPOSURE	W4	300PL5 J3–35	300PL6 J2–35
NC	W4	300PL5 J3–28	300PL6 J2–28
NC	W4	300PL5 J3–45	300PL6 J2–45
NC	W4	300PL5 J3–46	300PL6 J2–46
NC	W4	300PL5 J3–47	300PL6 J2–47
NC	W4	300PL5 J3–48	300PL6 J2–48
NC	W4	300PL5 J3–49	300PL6 J2–49
NC	W4	300PL5 J3–50	300PL6 J2–50
+15V_CMD	W5	300PL6J8–6	300PL8 J9–6
+15V_CMD	W5	300PL6J8–12	300PL5 J11–6
–15V	W5	300PL6J8–1	300PL8 J9–1
–15V	W5	300PL6J8–7	300PL5 J11–1
+15V	W5	300PL6J8–3	300PL8 J9–3
+15V	W5	300PL6J8–9	300PL5 J11–3
VCC_	W5	300PL6J8–2	300PL8 J9–2

SIGNAL NAME	WIRING	FROM	TO
VCC_	W5	300PL6J8–8	300PL5 J11–2
GROUND	W5	300PL6J8–4	300PL8 J9–4
GROUND	W5	300PL6J8–5	300PL8 J9–11
GROUND	W5	300PL6J8–10	300PL5 J11–4
GROUND	W5	300PL6J8–11	300PL5 J11–5
_LVPS_OK	W6	300PL5 J5–27	300PL8 J2–27
MAINS_OK	W6	300PL5 J5–23	300PL8 J2–23
DC_BUS_OK	W6	300PL5 J5–25	300PL8 J2–25
GRAPHY_SW_OUT	W6	300PL5 J5–29	300PL8 J2–29
SECURITY_READ	W6	300PL5 J5–14	300PL8 J2–14
XRAY_ON	W6	300PL5 J5–17	300PL8 J2–17
HV_TEST	W6	300PL5 J5–33	300PL8 J2–33
HV_LOAD+	W6	300PL5 J5–8	300PL8 J2–8
HV_LOAD–	W6	300PL5 J5–9	300PL8 J2–9
SRI_HV+	W6	300PL5 J5–2	300PL8 J2–2
SRI_HV–	W6	300PL5 J5–3	300PL8 J2–3
HV_STROBE+	W6	300PL5 J5–6	300PL8 J2–6
HV_STROBE–	W6	300PL5 J5–5	300PL8 J2–5
_HV_DROPOUT	W6	300PL8 J2–26	300PL5 J5–26
_HV_MAX	W6	300PL8 J2–28	300PL5 J5–28
_I_CONV_MAX	W6	300PL8 J2–24	300PL5 J5–24
_EXPOS_TIME_MAX	W6	300PL8 J2–18	300PL5 J5–18
_TIMEOUT_REGUL	W6	300PL8 J2–20	300PL5 J5–20
_SUPPLY_DEFECT	W6	300PL8 J2–16	300PL5 J5–16
_SCW	W6	300PL8 J2–22	300PL5 J5–22
HV_OK	W6	300PL8 J2–32	300PL5 J5–32
_HL_SECURITY	W6	300PL8 J2–19	300PL5 J5–19
_LL_SECURITY	W6	300PL8 J2–21	300PL5 J5–21
GROUND	W6	300PL8 J2–1	300PL5 J5–1
GROUND	W6	300PL8 J2–4	300PL5 J5–4

SIGNAL NAME	WIRING	FROM	TO
GROUND	W6	300PL8 J2–7	300PL5 J5–7
GROUND	W6	300PL8 J2–10	300PL5 J5–10
GROUND	W6	300PL8 J2–13	300PL5 J5–13
KV_SUP_5/KV_INF_5	W6	300PL8 J2–15	300PL5 J5–15
MA_MEAS+	W6	300PL8 J2–12	300PL5 J5–12
MA_MEAS–	W6	300PL8 J2–11	300PL5 J5–11
_MA_MAX	W6	300PL8 J2–30	300PL5 J5–30
NC	W6	300PL8 J2–34	300PL5 J5–34
NC	W6	300PL8 J2–35	300PL5 J5–35
NC	W6	300PL8 J2–36	300PL5 J5–36
NC	W6	300PL8 J2–37	300PL5 J5–37
NC	W6	300PL8 J2–38	300PL5 J5–38
NC	W6	300PL8 J2–39	300PL5 J5–39
NC	W6	300PL8 J2–40	300PL5 J5–40
–15VS	W7	300PL17 J1–1	300PL6 J9–1
_LVS_PRE	W7	300PL6 J9–2	300PL17 J1–2
_LVS_ON	W7	300PL6 J9–3	300PL17 J1–3
–15V	W7	300PL17 J1–4	300PL6 J9–4
GROUND	W7	300PL17 J1–5	300PL6 J9–5
+5VS	W7	300PL17 J1–6	300PL6 J9–6
+15VS	W7	300PL17 J1–7	300PL6 J9–7
GROUND	W7	300PL17 J1–8	300PL6 J9–8
VCC_	W7	300PL17 J1–9	300PL6 J9–9
+15V	W7	300PL17 J1–10	300PL6 J9–10
GROUND	W7	300PL17 J1–11	300PL6 J9–11
VCC_	W7	300PL17 J1–12	300PL6 J9–12
CONT_RX–	W8	300PL6 J4–6	300PL9 J4–6
CONT_RX+	W8	300PL6 J4–8	300PL9 J4–8
CONT_TX–	W8	300PL9 J4–4	300PL6 J4–4
CONT_TX+	W8	300PL9 J4–2	300PL6 J4–2

SIGNALS NAMES

SIGNAL NAME	WIRING	FROM	TO
_400V	W8	300PL9 J4–17	300PL6 J4–17
_310V	W8	300PL9 J4–18	300PL6 J4–18
_180V	W8	300PL9 J4–19	300PL6 J4–19
_30V	W8	300PL9 J4–20	300PL6 J4–20
_STARTER_ACCEL_IN	W8	300PL9 J4–13	300PL6 J4–13
_STARTER_PRES_IN	W8	300PL9 J4–14	300PL6 J4–14
_MAINS_DETECT	W8	300PL9 J4–15	300PL6 J4–15
+5VS	W8	300PL6 J4–1	300PL9 J4–1
+5VS	W8	300PL6 J4–3	300PL9 J4–3
+5VS	W8	300PL6 J4–5	300PL9 J4–5
COMMON_SW	W8	300PL6 J4–10	300PL9 J4–10
GRAPHY_SW_IN	W8	300PL9 J4–27	300PL6 J4–27
PREPA_SW_IN	W8	300PL9 J4–29	300PL6 J4–29
CMD_LIGHT_XRAY	W8	300PL6 J4–25	300PL9 J4–25
EMERGENCY_SW1	W8	300PL6 J4–11	300PL9 J4–11
EMERGENCY_SW3	W8	300PL6 J4–12	300PL9 J4–12
_BLINK	W8	300PL6 J4–9	300PL9 J4–9
0V/GND	W8	300PL6 J4–31	300PL9 J4–31
0V/GND	W8	300PL6 J4–32	300PL9 J4–32
0V/GND	W8	300PL6 J4–33	300PL9 J4–33
0V/GND	W8	300PL6 J4–34	300PL9 J4–34
+15VS	W8	300PL6 J4–21	300PL9 J4–21
+15VS	W8	300PL6 J4–22	300PL9 J4–22
+15VS	W8	300PL6 J4–24	300PL9 J4–24
+15V_ON	W8	300PL9 J4–16	300PL6 J4–16
_PWR_ON	W8	300PL6 J4–26	300PL9 J4–26
_PWR_PRE	W8	300PL6 J4–30	300PL9 J4–30
_PWR_DISCH	W8	300PL6 J4–28	300PL9 J4–28
_TRACK_2_SEL	W9	300PL6 J6–14	300PL11 J1–14
BIAS_VOLT_MEAS_B	W9	300PL11 J1–30	300PL6 J6–30

SIGNAL NAME	WIRING	FROM	TO
BIAS_VOLT_MEAS_A	W9	300PL11 J1–29	300PL6 J6–29
BIAS_CDE_T1	W9	300PL6 J6–19	300PL11 J1–19
BIAS_CDE_T2	W9	300PL6 J6–17	300PL11 J1–17
HEAT_TRIG_1_A	W9	300PL6 J6–2	300PL11 J1–2
HEAT_TRIG_1_B	W9	300PL6 J6–4	300PL11 J1–4
HEAT_TRIG_2_B	W9	300PL6 J6–3	300PL11 J1–3
HEAT_TRIG_2_A	W9	300PL6 J6–1	300PL11 J1–1
+15V_DRIV	W9	300PL6 J6–23	300PL11 J1–23
+15V_DRIV	W9	300PL6 J6–24	300PL11 J1–24
–15V	W9	300PL6 J6–7	300PL11 J1–7
–15V	W9	300PL6 J6–8	300PL11 J1–8
+15V	W9	300PL6 J6–9	300PL11 J1–9
+15V	W9	300PL6 J6–10	300PL11 J1–10
+15V	W9	300PL6 J6–27	300PL11 J1–27
+15V	W9	300PL6 J6–28	300PL11 J1–28
0V/GND	W9	300PL6 J6–5	300PL11 J1–5
0V/GND	W9	300PL6 J6–6	300PL11 J1–6
0V/GND	W9	300PL6 J6–13	300PL11 J1–13
0V/GND	W9	300PL6 J6–15	300PL11 J1–15
0V/GND	W9	300PL6 J6–16	300PL11 J1–16
0V/GND	W9	300PL6 J6–18	300PL11 J1–18
0V/GND	W9	300PL6 J6–20	300PL11 J1–20
0V/GND	W9	300PL6 J6–21	300PL11 J1–21
0V/GND	W9	300PL6 J6–22	300PL11 J1–22
0V/GND	W9	300PL6 J6–25	300PL11 J1–25
0V/GND	W9	300PL6 J6–26	300PL11 J1–26
HEAT_CUR_MEAS_B	W9	300PL11 J1–12	300PL6 J6–12
HEAT_CUR_MEAS_A	W9	300PL11 J1–11	300PL6 J6–11
+12V_COUPE	W10	300PL6 J5–19	300PL12 J1–19
+12V_COUPE	W10	300PL6 J5–20	300PL12 J1–20

SIGNALS NAMES

SIGNAL NAME	WIRING	FROM	TO
+12V_COUPE	W10	300PL6 J5–21	300PL12 J1–21
+12V_COUPE	W10	300PL6 J5–22	300PL12 J1–22
CDE_T1	W10	300PL6 J5–1	300PL12 J1–1
BLOC_T1	W10	300PL6 J5–3	300PL12 J1–3
BLOC_T1	W10	300PL6 J5–5	300PL12 J1–5
CDE_T2	W10	300PL6 J5–2	300PL12 J1–2
BLOC_T2	W10	300PL6 J5–4	300PL12 J1–4
BLOC_T2	W10	300PL6 J5–6	300PL12 J1–6
CDE_T3	W10	300PL6 J5–7	300PL12 J1–7
BLOC_T3	W10	300PL6 J5–9	300PL12 J1–9
BLOC_T3	W10	300PL6 J5–11	300PL12 J1–11
CDE_T4	W10	300PL6 J5–8	300PL12 J1–8
BLOC_T4	W10	300PL6 J5–10	300PL12 J1–10
BLOC_T4	W10	300PL6 J5–12	300PL12 J1–12
CDE_T5	W10	300PL6 J5–13	300PL12 J1–13
BLOC_T5	W10	300PL6 J5–15	300PL12 J1–15
BLOC_T5	W10	300PL6 J5–17	300PL12 J1–17
CDE_T6	W10	300PL6 J5–14	300PL12 J1–14
BLOC_T6	W10	300PL6 J5–16	300PL12 J1–16
BLOC_T6	W10	300PL6 J5–18	300PL12 J1–18
MESURE_PHASE_1	W10	300PL12 J1–25	300PL6 J5–25
0V_PHASE_1	W10	300PL12 J1–26	300PL6 J5–26
MESURE_PHASE_3	W10	300PL12 J1–27	300PL6 J5–27
0V_PHASE_3	W10	300PL12 J1–28	300PL6 J5–28
SUR_I_H	W10	300PL12 J1–33	300PL6 J5–33
SUR_I_B	W10	300PL12 J1–34	300PL6 J5–34
FEEDBACK_MA	W11	HV TANK GKB–14	300PL8 J10–1
0V/GROUND	W11	HV TANK GKB–15	300PL8 J10–1
BIAS_TRANSF_A	W11	300PL11 J2–4	HV TANK GKB–
BIAS_TRANSF_B	W11	300PL11 J2–1	HV TANK GKB–

SIGNAL NAME	WIRING	FROM	TO
0V/GND	W11	300PL11 J2–7	HV TANK GKB–
0V/GND	W11	300PL11 J2–10	HV TANK GKB–
HEAT_TRANSF_TRACK_1	W11	300PL11 J2–3	HV TANK GKB–
HEAT_TRANSF_TRACK_2	W11	300PL11 J2–6	HV TANK GKB–
HEAT_TRANSF_COMMON	W11	300PL11 J2–9	HV TANK GKB–
HEAT_TRANSF_COMMON	W11	300PL11 J2–12	HV TANK GKB–
+SUPPLY_HEATER	W12	300PL9 J3–7	300PL11 J3–3
+SUPPLY_HEATER	W12	300PL9 J3–10	300PL11 J3–6
–DC_BUS	W12	300PL9 J3–9	300PL11 J3–1
–DC_BUS	W12	300PL9 J3–12	300PL11 J3–4
+SUPPLY_START	W12	300PL9 J3–1	300PL12 J3–3
+SUPPLY_START	W12	300PL9 J3–4	300PL12 J3–6
–SUPPLY_START	W12	300PL9 J3–3	300PL12 J3–1
–SUPPLY_START	W12	300PL9 J3–6	300PL12 J3–4
CONT_TX–	W13	100PL2 J3–1	300PL9 J5–1
CONT_RX–	W13	300PL9 J5–2	100PL2 J3–2
COMMON_SW	W13	300PL9 J5–3	100PL2 J3–3
COMMON_SW	W13	300PL9 J5–4	100PL2 J3–4
NC	W13	300PL9 J5–5	
EMERGENCY_SW3	W13	300PL9 J5–6	100PL2 J3–6
V_ON	W13	300PL9 J5–7	100PL2 J3–7
GROUND	W13	300PL9 J5–8	100PL2 J3–8
+27VDC_CONT_PANEL	W13	300PL9 J5–9	100PL2 J3–9
+27VDC_CONT_PANEL	W13	300PL9 J5–10	100PL2 J3–10
0_27VDC	W13	300PL9 J5–11	100PL2 J3–11
0_27VDC	W13	300PL9 J5–12	100PL2 J3–12
NC	W13	300PL9 J5–13	
CONT_TX+	W13	100PL2 J3–14	300PL9 J5–14
CONT_RX+	W13	300PL9 J5–15	100PL2 J3–15
PREPA_BUTTON	W13	300PL9 J5–16	100PL2 J3–16

SIGNAL NAME	WIRING	FROM	TO
GRAPHY_BUTTON	W13	300PL9 J5–17	100PL2 J3–17
NC	W13	300PL9 J5–18	
B_ON	W13	300PL9 J5–19	100PL2 J3–19
V_OFF	W13	300PL9 J5–20	100PL2 J3–20
+12V	W13	300PL9 J5–21	100PL2 J3–21
+27VDC_CONT_PANEL	W13	300PL9 J5–22	100PL2 J3–22
+27VDC_CONT_PANEL	W13	300PL9 J5–23	100PL2 J3–23
0_27VDC	W13	300PL9 J5–24	100PL2 J3–24
0_27VDC	W13	300PL9 J5–25	100PL2 J3–25
+27VDC_LIGHT_ROT	W14	300PL13 J1–1	300PL2 J3–1
+27VDC_LIGHT_ROT	W14	300PL13 J1–2	300PL2 J3–2
0_27VDC	W14	300PL13 J1–3	300PL2 J3–4
+27VDC_LIGHT_ROT	W14	300PL13 J1–4	300PL2 J3–3
0_27VDC	W14	300PL13 J1–5	300PL2 J3–5
0_27VDC	W14	300PL13 J1–6	300PL2 J3–6
+27VDC_ELEV_COMP	W14	300PL13 J1–7	300PL1 J5–1
+27VDC_ELEV_COMP	W14	300PL13 J1–8	300PL1 J5–2
0_27VDC	W14	300PL13 J1–9	300PL9 J6–3
+27VDC_CONT_PANEL	W14	300PL13 J1–10	300PL9 J6–1
0_27VDC	W14	300PL13 J1–11	300PL1 J5–4
0_27VDC	W14	300PL13 J1–12	300PL1 J5–5
NC	W14		300PL1 J5–3
NC	W14		300PL1 J5–6
AC_PH1_RETURN	W15	300PL9 J10–1	300PL17 J3–1
NC	W15	300PL9 J10–2	300PL17 J3–2
INRUSH_REL_1	W15	300PL9 J10–3	300PL17 J3–3
AC_N_PH2	W15	300PL9 J10–4	300PL17 J3–4
NC	W15	300PL9 J10–5	300PL17 J3–5
INRUSH_REL_2	W15	300PL9 J10–6	300PL17 J3–6
PREPA_SW_IN	W16	300PL9 J7–10	300PL14

SIGNAL NAME	WIRING	FROM	TO
PREPA_BUTTON	W16	300PL9 J7–9	300PL14
GRAPHY_SW_IN	W16	300PL9 J7–8	300PL14 J4–8
GRAPHY_BUTTON	W16	300PL9 J7–7	300PL14 J4–7
+5VS	W16	300PL9 J7–1	300PL14 J4–1
+5VS	W16	300PL9 J7–3	300PL14 J4–3
CMD_LIGHT_ON	W16	300PL9 J7–2	300PL14
CMD_LIGHT_XRAY	W16	300PL9 J7–4	300PL14
COMPRESSION	W17a	300PL1 J10A–1	PADDLE–A
OPERATOR PRESENCE	W17a	300PL1 J10A–2	PADDLE–A
COMMON	W17a	300PL1 J10A–3	PADDLE–A
DECOMPRESSION	W17a	300PL1 J10A–4	PADDLE–A
NC	W17a	300PL1 J10A–5	PADDLE–A
0V/GND	W17a	300PL1 J10A–6	PADDLE–A
COMPRESSION	W17b	300PL1 J10B–1	PADDLE–B
OPERATOR PRESENCE	W17b	300PL1 J10B–2	PADDLE–B
COMMON	W17b	300PL1 J10B–3	PADDLE–B
DECOMPRESSION	W17b	300PL1 J10B–4	PADDLE–B
NC	W17b	300PL1 J10B–5	PADDLE–B
0V/GND	W17b	300PL1 J10B–6	PADDLE–B
+CAPA	W18	300PL9	300PL10
–CAPA	W18	300PL9	300PL10
+15V_GATE	W19	300PL8 J3–7	300PL10 J1–7
+15V_GATE	W19	300PL8 J3–9	300PL10 J1–9
+15V_GATE	W19	300PL8 J3–11	300PL10 J1–11
+15V_GATE	W19	300PL8 J3–13	300PL10 J1–13
0V/GND	W19	300PL8 J3–15	300PL10 J1–15
G1CMD1	W19	300PL8 J3–3	300PL10 J1–3
G1CMD2	W19	300PL8 J3–1	300PL10 J1–1
G2CMD1	W19	300PL8 J3–31	300PL10 J1–31
G2CMD2	W19	300PL8 J3–33	300PL10 J1–33

SIGNAL NAME	WIRING	FROM	TO
0V/GND	W19	300PL8 J3–5	300PL10 J1–5
0V/GND	W19	300PL8 J3–6	300PL10 J1–6
0V/GND	W19	300PL8 J3–15	300PL10 J1–15
0V/GND	W19	300PL8 J3–16	300PL10 J1–16
0V/GND	W19	300PL8 J3–17	300PL10 J1–17
0V/GND	W19	300PL8 J3–18	300PL10 J1–18
0V/GND	W19	300PL8 J3–19	300PL10 J1–19
+15V_CMD	W19	300PL8 J3–20	300PL10 J1–20
0V/GND	W19	300PL8 J3–21	300PL10 J1–21
+15V_CMD	W19	300PL8 J3–22	300PL10 J1–22
0V/GND	W19	300PL8 J3–23	300PL10 J1–23
+15V_CMD	W19	300PL8 J3–24	300PL10 J1–24
0V/GND	W19	300PL8 J3–25	300PL10 J1–25
+15V_CMD	W19	300PL8 J3–26	300PL10 J1–26
0V/GND	W19	300PL8 J3–27	300PL10 J1–27
+15V_CMD	W19	300PL8 J3–28	300PL10 J1–28
0V/GND	W19	300PL8 J3–29	300PL10 J1–29
0V/GND	W19	300PL8 J3–32	300PL10 J1–32
0V/GND	W19	300PL8 J3–34	300PL10 J1–34
CMeasA	W19	300PL10 J1–2	300PL8 J3–2
CMeasB	W19	300PL10 J1–4	300PL8 J3–4
_LVPS_OK2	W19	300PL8 J3–30	300PL10–30
AC_PH1	W20	300–S1	300PL9
AC_N_PH2	W20	300–S1	300PL9
KV_MEAS	W21	300PL15 J1	300PL8 J4
M3	W22	300PL10	HV TANK GKA–1
M5	W22	300PL10	HV TANK GKA–2
W23			Ground Wiring
W24			Ground Wiring
W25			Ground Wiring

SIGNAL NAME	WIRING	FROM	TO
AC_PH1_RETURN	W27	300–S1 13	300PL9 J11–1
NC	W27		300PL9 J11–2
AC_PH1	W27	300–S1 14	300PL9 J11–3
AC_PH1_PRE	W28	300PL9 J9–1	300PL18 J1–3
NC	W28	300PL9 J9–2	300PL18 J1–2
AC_N_PH2	W28	300PL9 J9–3	300PL18 J1–1
EMERGENCY_SW1	W29	300PL18 J2–1	300PL9 J2–1
NC	W29	300PL18 J2–2	
INRUSH_REL_2	W29	300PL18 J2–3	300PL9 J2–2
+LVPS_SUPPLY	W30	300PL17 J2–1	300PL7 SK1–1
NC	W30	300PL17 J2–2	300PL7 SK1–2
–LVPS_SUPPLY	W30	300PL17 J2–3	300PL7 SK1–3
+15VBF	W31	300PL7 SK2–1	300PL17 J4–10
+15VBF	W31	300PL7 SK2–1	300PL17 J4–11
+5VBF	W31	300PL7 SK2–2	300PL17 J4–4
+5VBF	W31	300PL7 SK2–3	300PL17 J4–7
GROUND	W31	300PL7 SK2–4	300PL17 J4–6
GROUND	W31	300PL7 SK2–5	300PL17 J4–9
GROUND	W31		300PL17 J4–3
GROUND	W31		300PL17 J4–8
GROUND	W31		300PL17 J4–12
–15VBF	W31	300PL7 SK2–6	300PL17 J4–1
–15VBF	W31	300PL7 SK2–6	300PL17 J4–2
R1(+5v Charge)	W31	300PL17 J4–5	
R1(+5v Charge)	W31	300PL17 J4–8	
R2(+15v Charge)	W31	300PL17 J4–11	
R2(+15v Charge)	W31	300PL17 J4–12	
LAPTOP_RX	W32	LAPTOP	300PL3 J3–2
LAPTOP_TX	W32	300PL3 J3–3	LAPTOP
NC	W32	300PL3 J3–4	

SIGNALS NAMES

SIGNAL NAME	WIRING	FROM	TO
GND	W32	300PL3 J3–5	LAPTOP
NC	W32	300PL3 J3–6	
NC	W32	300PL3 J3–7	
NC	W32	300PL3 J3–8	
NC	W32	300PL3 J3–9	
NC	W33	300PL3 J2–1	
PDD_RX	W33	PDD	300PL3 J2–2
PDD_TX	W33	300PL3 J2–3	PDD
NC	W33	300PL3 J2–4	
GND	W33	300PL3 J2–5	PDD
NC	W33	300PL3 J2–6	
NC	W33	300PL3 J2–7	
NC	W33	300PL3 J2–8	
NC	W33	300PL3 J2–9	
NC	W33	300PL3 J3–1	
W35			GROUND WIRING
MAINS PH1	W50		
MAINS PH2/N	W50		300PL6
PE/GND	W50		300PL6
PHASE1–B	W100	300PL1 J6–1	JP200–1
PHASE1+O	W100	300PL1 J6–2	JP200–2
PHASE–Y	W100	300PL1 J6–3	JP200–3
PHASE+R	W100	300PL1 J6–4	JP200–4
GND	W101	300PL5 J8–1	200PL5 J4–1
VCC	W101	300PL5 J8–2	200PL5 J4–2
SRI_HTPM–	W101	300PL5 J8–3	200PL5 J4–3
SRI_HTPM+	W101	300PL5 J8–4	200PL5 J4–4
HTPM_LOAD–	W101	300PL5 J8–5	200PL5 J4–5
HTPM_LOAD+	W101	300PL5 J8–6	200PL5 J4–6
HTPM_STROBE–	W101	300PL5 J8–7	200PL5 J4–7

SIGNAL NAME	WIRING	FROM	TO
HTPM_STROBE+	W101	300PL5 J8–8	200PL5 J4–8
GND	W101	300PL5 J8–9	200PL5 J4–9
+15VF	W101	300PL5 J8–10	200PL5 J4–10
PM_MEAS–	W101	200PL5 J4–11	300PL5 J8–11
PM_MEAS+	W101	200PL5 J4–12	300PL5 J8–12
–15VF	W101	300PL5 J8–13	200PL5 J4–13
I_HT_CMD	W101	300PL5 J8–14	200PL5 J4–14
NC	W101	300PL5 J8–15	200PL5 J4–15
GND	W101	300PL5 J8–16	200PL5 J4–16
0V/GND	W102	300PL5 J9–1	200PL3–J1–1
CASSETTE_PRES	W102	200PL3–J1–2	300PL5 J9–2
0V/GND	W102	300PL5 J9–3	200PL3–J1–3
GRID_PRES	W102	200PL3–J1–4	300PL5 J9–4
0V/GND	W102	300PL5 J9–5	200PL3–J1–5
24X30	W102	200PL3–J1–6	300PL5 J9–6
+30V_STATIF	W102	300PL5 J9–7	200PL3–J1–7
START_GRID	W102	300PL5 J9–8	200PL3–J1–8
	W102	300PL5 J9–9	200PL3–J1–9
SYNC_GRID	W102	200PL3–J1–10	300PL5 J9–10
+15VF	W102	300PL5 J9–11	200PL3–J1–11
EXPO_DIS_LED	W102	300PL5 J9–12	200PL3–J1–12
BUCKY_FAIL	W102	200PL3–J1–13	300PL5 J9–13
+15VF	W102	300PL5 J9–14	200PL3–J1–14
–15VF	W102	300PL5 J9–15	200PL3–J1–15
–15VF	W102	300PL5 J9–16	200PL3–J1–16
NC	W102	300PL5 J9–17	200PL3–J1–17
NC	W102	300PL5 J9–18	200PL3–J1–18
NC	W102	300PL5 J9–19	200PL3–J1–19
NC	W102	300PL5 J9–20	200PL3–J1–20
NC	W103	200PL9 J1–1	300PL5 J6–1

SIGNAL NAME	WIRING	FROM	TO
FILTER_POS_REF	W103	200PL9 J1–2	300PL5 J6–2
NC	W103	200PL9 J1–3	300PL5 J6–3
MAG_0	W103	200PL9 J1–4	300PL5 J6–4
MAG_1	W103	200PL9 J1–5	300PL5 J6–5
MAG_2	W103	200PL9 J1–6	300PL5 J6–6
NC	W103	200PL9 J1–7	300PL5 J6–7
GND	W103	300PL5 J6–8	200PL9 J1–8
THICKNESS–	W103	200PL9 J1–9	300PL5 J6–9
THICKNESS+	W103	200PL9 J1–10	300PL5 J6–10
GND	W103	300PL5 J6–11	200PL9 J1–11
GND	W103	300PL5 J6–12	200PL9 J1–12
ANGLE–	W103	200PL9 J1–13	300PL5 J6–13
ANGLE+	W103	200PL9 J1–14	300PL5 J6–14
+30V_STATIF	W103	300PL5 J6–15	200PL9 J1–15
+30V_STATIF	W103	300PL5 J6–16	200PL9 J1–16
MOT_FILTER1–	W103	300PL5 J6–17	200PL9 J1–17
MOT_FILTER1+	W103	300PL5 J6–18	200PL9 J1–18
+15VF	W103	300PL5 J6–19	200PL9 J1–19
+15VF	W103	300PL5 J6–20	200PL9 J1–20
MOT_FILTER2–	W103	300PL5 J6–21	200PL9 J1–21
MOT_FILTER2+	W103	300PL5 J6–22	200PL9 J1–22
GND	W103	300PL5 J6–23	200PL9 J1–23
FILTER_STDBY	W103	300PL5 J6–24	200PL9 J1–24
–15VF	W103	300PL5 J6–25	200PL9 J1–25
NC	W103	200PL9 J1–26	300PL5 J6–26
ELEV+_SW	W104	200PL1 J1–1	300PL5 J7–1
ELEV–_SW	W104	200PL1 J1–2	300PL5 J7–2
DIAPH(1)	W104	200PL1 J1–3	300PL5 J7–3
DIAPH(0)	W104	200PL1 J1–4	300PL5 J7–4
DIAPH(2)	W104	200PL1 J1–6	300PL5 J7–5

SIGNAL NAME	WIRING	FROM	TO
DIAPH(3)	W104	200PL1 J1–5	300PL5 J7–6
GND	W104	300PL5 J7–7	200PL1 J1–7
GND	W104	300PL5 J7–8	200PL1 J1–8
CONS_FORCE–	W104	200PL1 J1–9	300PL5 J7–9
CONS_FORCE+	W104	200PL1 J1–10	300PL5 J7–10
+15VF	W104	300PL5 J7–11	200PL1 J1–11
+15VF	W104	300PL5 J7–12	200PL1 J1–12
INC_KNOB1–	W104	200PL1 J1–13	300PL5 J7–13
INC_KNOB1+	W104	200PL1 J1–14	300PL5 J7–14
OPER_PRES_SW	W104	200PL1 J1–15	300PL5 J7–15
LIGHT_SW	W104	200PL1 J1–16	300PL5 J7–16
INC_KNOB2–	W104	200PL1 J1–17	300PL5 J7–17
INC_KNOB2+	W104	200PL1 J1–18	300PL5 J7–18
GND	W104	300PL5 J7–19	200PL1 J1–19
NC	W104	200PL1 J1–20	300PL5 J7–20
ROT_SW	W104	200PL1 J1–21	300PL5 J7–21
TUBE_SECURITY	W104	200PL1 J1–22	300PL5 J7–22
EMERGENCY_SW2	W104	300PL5 J7–23	200PL1 J1–23
EMERGENCY_SW1	W104	200PL1 J1–24	300PL5 J7–24
+30V_STATIF	W104	300PL5 J7–25	200PL1 J1–25
FAN_DETECT	W104	200PL1 J1–26	300PL5 J7–26
NC	W104	200PL1 J1–27	300PL5 J7–27
NC	W104	200PL1 J1–28	300PL5 J7–28
NC	W104	200PL1 J1–29	300PL5 J7–29
NC	W104	200PL1 J1–30	300PL5 J7–30
NC	W104	200PL1 J1–31	300PL5 J7–31
NC	W104	200PL1 J1–32	300PL5 J7–32
NC	W104	200PL1 J1–33	300PL5 J7–33
NC	W104	200PL1 J1–34	300PL5 J7–34
LIGHT+	W105	300PL2 J4–A	200L1/W202

SIGNAL NAME	WIRING	FROM	TO
LIGHT–	W105	300PL2 J4–B	200L1/W202
ROT+	W106	300PL2 J2–A	200Y2/W201
ROT–	W106	300PL2 J2–B	200Y2/W201
W107			GROUND WIRING
HT+	W108	HV TANK	X_RAY TUBE
HT–	W109	HV TANK	X_RAY TUBE
PHASE_1	W110	300PL12 J2–2	X_RAY TUBE
PHASE_2	W110	300PL12 J2–4	X_RAY TUBE
PHASE_3	W110	300PL&2 J2–6	X_RAY TUBE
CONTACT+	W111	300PL1 J9–1	200S3
NC	W111	300PL1 J9–2	
CONTACT–	W111	300PL1 J9–3	200S3
CONTACT+	W112	300PL1 J8–1	200S4
NC	W112	300PL1 J8–2	
CONTACT–	W112	300PL1 J8–3	200S4
CONTACT+	W113	300PL1 J7–1	200S5
NC	W113	300PL1 J7–2	
CONTACT–	W113	300PL1 J7–3	200S5
GND	W114	300PL5 J4–1	200PL4 J1–1
VCC	W114	300PL5 J4–2	200PL4 J1–2
DISPLAY_LOAD–(0)	W114	300PL5 J4–3	200PL4 J1–3
DISPLAY_LOAD+(0)	W114	300PL5 J4–4	200PL4 J1–4
DISPLAY_LOAD–(1)	W114	300PL5 J4–5	200PL4 J1–5
DISPLAY_LOAD+(1)	W114	300PL5 J4–6	200PL4 J1–6
SRI_DISPLAY–	W114	300PL5 J4–7	200PL4 J1–7
SRI_DISPLAY+	W114	300PL5 J4–8	200PL4 J1–8
DISPLAY_LOAD–(2)	W114	300PL5 J4–9	200PL4 J1–9
DISPLAY_LOAD+(2)	W114	300PL5 J4–10	200PL4 J1–10
DISPLAY_STROBE–	W114	300PL5 J4–11	200PL4 J1–11
DISPLAY_STROBE+	W114	300PL5 J4–12	200PL4 J1–12

SIGNAL NAME	WIRING	FROM	TO
DISPLAY_LOAD–(3)	W114	300PL5 J4–13	200PL4 J1–13
DISPLAY_LOAD+(3)	W114	300PL5 J4–14	200PL4 J1–14
VCC	W114	300PL5 J4–15	200PL4 J1–15
GND	W114	300PL5 J4–16	200PL4 J1–16
ELEV+	W115	JP204 1	200M1
ELEV–	W115	JP204 2	200M1
ELEV+	W116	300PL1 J2–1	JP204 1
ELEV–	W116	300PL1 J2–2	JP204 2
W120			GROUND WIRING
W121			GROUND WIRING
W122			GROUND WIRING
W123			GROUND WIRING
W124			GROUND WIRING
PHASE1–B	W200	JP200 –1	200M2
PHASE1+O	W200	JP200 –2	200M2
PHASE–Y	W200	JP200 –3	200M2
PHASE+R	W200	JP200 –4	200M2
+30V_ROTATION	W201	JP201–1	200Y2
R_ON_POWER	W201	JP201–2	200Y2
+30V_ALIM	W202	JP202–1	200L1
0VP	W202	JP202–2	200L1
FAN+	W203	200PL1 J2–1	200Y1
FAN_OK	W203	200PL1 J2–2	200Y1
GND	W203	200PL1 J2–3	200Y1
EMERGENCY_SW1	W204	JP204	200S1
EMERGENCY_SW1	W204	JP204	200S1
EMERGENCY_SW2	W204	JP205	200S2
EMERGENCY_SW2	W204	JP205	200S2
EMERGENCY_SW1	W205	200PL1 J8–1	JP204
EMERGENCY_SW2	W205	200PL1 J8–2	JP205

SIGNAL NAME	WIRING	FROM	TO
TUBE_SECURITY+	W206	200PL1 J3–1	TUBE
TUBE_SECURITY	W206	200PL1 J3–2	TUBE
LED1+	W207	200PL1 J9–1	200PL2 J1–1
LED1–	W207	200PL1 J9–2	200PL2 J1–2
18x24	W207	200PL1 J9–3	200PL2 J1–3
24x30	W207	200PL1 J9–4	200PL2 J1–4
GND	W207	200PL1 J9–5	200PL2 J1–5
LED1–	W208	200PL1 J10–1	200PL2 J2–1
LED2–	W208	200PL1 J10–2	200PL2 J2–2
GF	W208	200PL1 J10–3	200PL2 J2–3
PF	W208	200PL1 J10–4	200PL2 J2–4
GND	W208	200PL1 J10–5	200PL2 J2–5
HIGH_THICKNESS	W209	JP203	200S2
THICKNESS	W209	JP203	200S2
GND	W209	JP203	200S2
GND	W210	PHOTOMULTIPLIER	GROUND
Red_Led_Cathode	W211	200PL3 J3–1	200H1
Red_Led_Anode	W211	200PL3 J3–2	200H1
VCC	W212	200PL8 J1–1	200PL7J2–1
INC_KNOB1	W212	200PL8 J1–2	200PL7J2–2
INC_KNOB2	W212	200PL8 J1–3	200PL7J2–3
GND	W212	200PL8 J1–4	200PL7J2–4
11V	W213	200PL7 J1–1	200PL1 J13–1
CONS_FORCE+	W213	200PL7 J1–2	200PL1 J13–2
CONS_FORCE–	W213	200PL7 J1–3	200PL1 J13–3
INC_KNOB1+	W213	200PL7 J1–4	200PL1 J13–4
INC_KNOB1–	W213	200PL7 J1–5	200PL1 J13–5
INC_KNOB2+	W213	200PL7 J1–6	200PL1 J13–6
INC_KNOB2–	W213	200PL7 J1–7	200PL1 J13–7
GND	W213	200PL7 J1–8	200PL1 J13–8

SIGNAL NAME	WIRING	FROM	TO
LED+_FILTER	W214	200PL9 J2–1	200B1
LED–_FILTER	W214	200PL9 J2–2	200B1
FILTER_POS_REF★	W214	200PL9 J2–3	200B1
GND	W214	200PL9 J2–4	200B1
POW_MOT_FILTER1–	W215	200PL9 J3–1	200M3
POW_MOT_FILTER1+	W215	200PL9 J3–2	200M3
POW_MOT_FILTER2–	W215	200PL9 J3–3	200M3
POW_MOT_FILTER2+	W215	200PL9 J3–4	200M3
HIGH_ANGLE	W216	200PL9 J4–1	200R1
ANGLE	W216	200PL9 J4–2	200R1
GND	W216	200PL9 J4–3	200R1
HIGH_THICKNESS	W217	200PL9 J5–1	JP203
THICKNESS	W217	200PL9 J5–2	JP203
GND	W217	200PL9 J5–3	JP203
GND	W218	200PL9 J6–1	200PL6 J1–1
MAG_0	W218	200PL9 J6–2	200PL6 J1–2
MAG_1	W218	200PL9 J6–3	200PL6 J1–3
–HT	W219	200PL5 J1	PHOTOMULTIPLIER
Ipm	W220	200PL5 J3–1	PHOTOMULTIPLIER
GND	W220	200PL5 J3–2	PHOTOMULTIPLIER
W222			GROUND WIRING
W224			GROUND WIRING
W225			GROUND WIRING
+30V_STATIF	W226	200PL3 J2–1	200PL10 J2–1A
GND	W226	200PL3 J2–2	200PL10 J2–1A
PHASE_1+	W226	200PL3 J2–3	200PL10 J2–2
PHASE_1–	W226	200PL3 J2–4	200PL10 J2–2
PHASE_2+	W226	200PL3 J2–5	200PL10 J2–3
PHASE_2–	W226	200PL3 J2–6	200PL10 J2–3
HOME	W226	200PL10 J2–4	200PL3 J2–7

SIGNAL NAME	WIRING	FROM	TO
GRID_ABSCENCE	W226	200PL10 J2–4	200PL3 J2–8
CASSETTE_PRES	W226	200PL10 J2–5	200PL3 J2–9
24X30_SIZE	W226	200PL10 J2–5	200PL3 J2–10
NC	W226	200PL3 J2–11	200PL10 J2–6
NC	W226	200PL3 J2–12	200PL10 J2–6
W228			GROUND WIRING
W229			GROUND WIRING
COMMUN_OPER_PRES_SW	W230a	200S6a	200PL1 J11–1
OPER_PRES_SW	W230a	200S6a	200PL1 J11–2
COMMUN_ELEV+_PRES_SW	W230a	200S6a	200PL1 J11–3
ELEV+_PRES_SW	W230a	200S6a	200PL1 J11–4
COMMUN_ELEV–_PRES_SW	W230a	200S6a	200PL1 J11–5
ELEV–_PRES_SW	W230a	200S6a	200PL1 J11–6
COMMUN_ROT_PRES_SW	W230a	200S6a	200PL1 J11–7
ROT_PRES_SW	W230a	200S6a	200PL1 J11–8
COMMUN_LIGHT_PRES_SW	W230a	200S6a	200PL1 J11–9
LIGHT_PRES_SW	W230a	200S6a	200PL1 J11–10
COMMUN_OPER_PRES_SW	W230b	200S6b	200PL1 J12–1
OPER_PRES_SW	W230b	200S6b	200PL1 J12–2
COMMUN_ELEV+_PRES_SW	W230b	200S6b	200PL1 J12–3
ELEV+_PRES_SW	W230b	200S6b	200PL1 J12–4
COMMUN_ELEV–_PRES_SW	W230b	200S6b	200PL1 J12–5
ELEV–_PRES_SW	W230b	200S6b	200PL1 J12–6
COMMUN_ROT_PRES_SW	W230b	200S6b	200PL1 J12–7
ROT_PRES_SW	W230b	200S6b	200PL1 J12–8
COMMUN_LIGHT_PRES_SW	W230b	200S6b	200PL1 J12–9
LIGHT_PRES_SW	W230b	200S6b	200PL1 J12–10

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CHAPTER 7 – ERROR LIST

SECTION 1
ERROR CODE STRUCTURE

The structure of the error messages, as displayed on the console (e.g. E64 [text] 162/012), is shown below:

E	6 4	Error text	1 6 2	/	0 1 2
a	bb		ccc		ddd

a : type of error
- I : Warning without exposure inhibition
- S : Warning with exposure inhibition
- E : Fault with exposure inhibition
- K : Fault generating power cut–off (safety)

bb: message number
ccc: subassembly ref. (hardware or software)
ddd: number indicating origin of fault

In the above example:

- E64 indicates an error concerning filter positionning and generating an exposure inhibition.
- 162/012 indicates no reference crossing during movement.
- E55 is the error code type listed in the Operator Manual. This code is easy to use and communicate, and is considered sufficient for customer use.
- 162/012 is the ”technical code”, recommended for GE internal communication.

The error code listing currently contains almost 300 codes. Around 190 of these codes concern software errors which, by definition, should never occur.

If a software error should occur, especially if it occurs several times, please inform Service Engineering, giving as many details as possible. If possible, provide the error codes file, on diskette.

The error code listing, below, only contains codes *ccc/ddd,* to facilitate technical communication.

Abbreviations used:

- IST: Installation
- MNT: Maintenance
- PM: Photomultiplier
- HTPM: PM high tension
- IPM: PM current
- VRTX: Real time operating system

ERROR LIST

CONSOLE MESSAGE	MEANING OF CODE	CODE
E06 Software Error	CPU software error: VRTX error during init	002/001
E14 CPU or INTERFACE Failure	CPU error: reboot by watch_dog_hard or reset button	002/002
E14 CPU or INTERFACE Failure	CPU error: reboot by watch_dog_soft	002/003
I24 Line power interruption	CPU error: reboot after power micro–failure LVPS	002/004
E14 CPU or INTERFACE Failure	CPU error: bus error	003/000
E14 CPU or INTERFACE Failure	CPU error: address error	003/001
E14 CPU or INTERFACE Failure	CPU error: format error	003/002
E14 CPU or INTERFACE Failure	CPU error: illegal instruction	003/003
E14 CPU or INTERFACE Failure	CPU error: privilege violation	003/004
E14 CPU or INTERFACE Failure	CPU error: trace error	003/005
E14 CPU or INTERFACE Failure	CPU error: emulation line 1010 error	003/006
E14 CPU or INTERFACE Failure	CPU error: emulation line 1011 error	003/007
E14 CPU or INTERFACE Failure	CPU error: CHK error	003/008
E14 CPU or INTERFACE Failure	CPU error:TRAPV error	003/009
E14 CPU or INTERFACE Failure	Interface: reset error	004/001
E14 CPU or INTERFACE Failure	Interface: read/write error on timer PTM1 (U17)	004/002
E14 CPU or INTERFACE Failure	Interface: read/write error on timer PTM1 (U17)	004/003
E14 CPU or INTERFACE Failure	Interface: read/write error on timer PTM2 (U18)	004/004
E14 CPU or INTERFACE Failure	Interface: read/write error on timer PTM2 (U18)	004/005
E14 CPU or INTERFACE Failure	Interface: interrupt error on DUART1	004/006
E14 CPU or INTERFACE Failure	Interface: PTM1 (U17) timer 1 defective	004/007
E14 CPU or INTERFACE Failure	Interface: PTM1 (U17) timer 2 defective	004/008
E14 CPU or INTERFACE Failure	Interface: PTM1 (U17) timer 3 defective	004/009
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E14 CPU or INTERFACE Failure	Interface: PTM2 (U18) timer 2 defective	004/011
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E14 CPU or INTERFACE Failure	Interface: interrupt error on PTM1 (U17) timer1	004/013
E14 CPU or INTERFACE Failure	Interface: interrupt error on PTM1 (U17) timer2	004/014
E14 CPU or INTERFACE Failure	Interface: interrupt error on PTM1 (U17) timer3	004/015

CONSOLE MESSAGE	MEANING OF CODE	CODE
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E14 CPU or INTERFACE Failure	Interface: interrupt error on PTM2 (U18) timer2	004/017
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E01 Generator Failure	Generator: Fault at exposure command	006/001
E01 Generator Failure	Generator: signal KV_INF_5kV not rising	006/002
E01 Generator Failure	Generator: Signal HV_OK not rising	006/003
E01 Generator Failure	Generator: fatal security triggered during exposure	006/004
E01 Generator Failure	Generator: fatal security triggered at end of exposure or signal HV_OF stay “high”	006/005
E01 Generator Failure	Generator: signal LL_SECURITY stays “high” after ”arcing recovery”	006/011
E01 Generator Failure	Gene init test: one fatal security input <>0: xxx identifies input. See seno error log.	007/xxx
E06 Software Error	Focus bias software error: unknown command	011/001
E06 Software Error	Focus bias software error: unknown task status	011/002
E02 Focus Bias Failure	Focus bias: signal Bias_OK ’high’ in stanby status	012/001
E02 Focus Bias Failure	Focus bias: signal Bias_OK stay ’low’ when bias generation starts	012/002
E02 Focus Bias Failure	Focus bias: signal Bias_OK goes ’low’ after stabilization	012/003
E02 Focus Bias Failure	Focus bias: signal Bias_OK stay ’high’ when bias generation stopped	012/004
E06 Software Error	Anode stater software error: unknown command	016/001
E06 Software Error	Anode stater software error: unknown task status	016/002
E03 Rotor Failure	Anode stater: signal failure in standby status	017/001
E03 Rotor Failure	Anode stater: signal failure during acceleration to 3000	017/003
E03 Rotor Failure	Anode stater: signal failure during rotation at 3000	017/005
E03 Rotor Failure	Anode stater: signal failure during rotation (speed < 3000 rpm)	017/007
E03 Rotor Failure	Anode stater: signal failure during rotation during 3000 rpm braking	017/009
K1 Rotorfail > Power Shutdown	K1 rotor security signal in standby status	017/010
K1 Rotorfail > Power Shutdown	K2 rotor security signal in rotation status	017/011
E06 Software Error	Heater software error: unknown command	021/001
E06 Software Error	Heater software error: unknown task status	021/002

CONSOLE MESSAGE	MEANING OF CODE	CODE
E06 Software Error	Heater software error: Heater scaling parameters (ICH) or heater values are not valid	021/003
E10 Heating Failure Track 1	Heater track 1: signal Heat_OK ’high’ in standby status	022/001
E10 Heating Failure Track 1	Heater track 1: signal Heat_OK stay ’low’ when heater started	022/002
E10 Heating Failure Track 1	Heater track 1: signal Heat_OK goes ’low’ during pre–heater phase	022/003
E10 Heating Failure Track 1	Heater track 1: signal Heat_OK goes ’low’ during 1st trigger	022/004
E10 Heating Failure Track 1	Heater track 1: signal Heat_OK goes ’low’ during exposure	022/005
E10 Heating Failure Track 1	Heater track 1: mA value not significant	022/006
E10 Heating Failure Track 1	Heater track 1: signal Heat_OK goes ’low’ after exposure	022/007
E10 Heating Failure Track 1	Heater track 1: signal Heat_OK stay ’high’ when heater stopped	022/008
E11 Heating Failure Track2	Heater track 2: signal Heat_OK ’high’ in stanby status	023/001
E11 Heating Failure Track2	Heater track 2: signal Heat_OK stay ’low’ when heater started	023/002
E11 Heating Failure Track2	Heater track 2: signal Heat_OK goes ’low’ during pre–heater phase	023/003
E11 Heating Failure Track2	Heater track 2: signal Heat_OK goes ’low’ during 1st trigger	023/004
E11 Heating Failure Track2	Heater track 2: signal Heat_OK goes ’low’ during exposure	023/005
E11 Heating Failure Track2	Heater track 2: mA value not significant	023/006
E11 Heating Failure Track2	Heater track 2: signal Heat_OK goes ’low’ after exposure	023/007
E11 Heating Failure Track2	Heater track 2: signal Heat_OK stay ’high’ when heater stopped	023/008
E06 Software Error	Grid software error: abnormal command received	026/001
E06 Software Error	Grid software error: abnormal Start command received	026/002
E06 Software Error	Grid software error: unknown task status	026/003
E06 Software Error	Grid software error: unknown task status	026/004
E71 BUCKY FAILURE	Grid sync: signal Synchro_Grid ’high’ in standby status	027/001
E71 BUCKY FAILURE	Signal Bucky_Fail high at the end autotest	027/002
E71 BUCKY FAILURE	No synchro grid signal detected during autotest	027/003
E71 BUCKY FAILURE	No synchro grid signal detected after start command	027/004
E71 BUCKY FAILURE	“Sync_Grid signal ”“low”“ during grid motion”	027/005
E71 BUCKY FAILURE	“Sync_Grid signal remains ”“high”“ after stop command”	027/007
E06 Software Error	Generator: delay task software error: unknown command	031/001
E06 Software Error	Generator: delay task software error: unknown task status	031/002

CONSOLE MESSAGE	MEANING OF CODE	CODE
E06 Software Error	HTPM/IPM software error: unknown command	036/001
E06 Software Error	HTPM/IPM software error: unwanted command	036/007
E06 Software Error	HTPM/IPM software error: unknow task status	036/008
E09 AEC Failure	HTPM/IPM: offset value outside tolerance	037/003
E09 AEC Failure	HTPM/IPM: invalid HTPM value (valid range = reference – 20%, +30%)	037/005
E06 Software Error	Gene thermal protection software: VRTX error	041/001
E06 Software Error	Gene thermal protection software: VRTX error	041/002
E06 Software Error	Gene thermal protection software: VRTX error	041/003
E06 Software Error	Gene thermal protection software: VRTX error	041/004
E06 Software Error	Gene thermal protection software: VRTX error	041/005
E06 Software Error	27V protection software: VRTX error	041/006
I23 Console Communication Fail	Gene to control panel communication driver: no reply from control panel after 2 attempts	062/000
E14 CPU or INTERFACE Failure	Gene date/time: access timeout during dater init	066/000
E14 CPU or INTERFACE Failure	Gene date/time: access timeout during read sequence	066/001
E14 CPU or INTERFACE Failure	Gene date/time: access timeout during write sequence	066/002
E14 CPU or INTERFACE Failure	Gene date/time: access timeout during time write sequence	066/003
E06 Software Error	Generator: Zero divide	067/000
E06 Software Error	Generator: floating point calculation error. xxx is VRTX task number	068/xxx
E12 Checksum Error	Generator : Checksum error on Battery Back–Up RAM (BBR)	071/081
E08 Power Supply Failure	Generator: timeout on signal DC_BUS_OK going ’liw’ or ’high’	071/082
E06 Software Error	Generator: error reading ’kV law table’ in 0 pt technique AOP	071/083
E06 Software Error	Exposure software error: unknown origin of aborted exposure	072/004
E06 Software Error	Exposure software error: aborted by PM in 2 pts technique	072/005
E06 Software Error	Exposure software error: unknown exposure technique	072/006
E06 Software Error	Exposure software error: unstable system task detected	072/007
E06 Software Error	Exposure software error: 0 pt or 1 pt exposure gantry absent	072/009
E06 Software Error	Exposure software error: unknown exposure request	072/010
E06 Software Error	Gene software error (IST, standby): parameter display problem	073/001
E06 Software Error	Gene software error (IST, standby): unknown tube type	073/002

ERROR LIST

CONSOLE MESSAGE	MEANING OF CODE	CODE
E06 Software Error	Gene software error (IST, standby): alpha = 0.0 when calculating value P_NDac_HTPM	073/003
E06 Software Error	Gene software error (IST, standby): incorrect thickness for correlation calculation	073/004
E06 Software Error	Gene software error (IST, standby): bias calibration task problem	073/005
E06 Software Error	Gene software error (IST, standby): heater scale calibration task problem	073/006
E06 Software Error	Gene software error (IST, standby): HV/DAC calibration task problem	073/007
E06 Software Error	Gene software error (IST, standby): FREG/HV calibration task problem	073/008
E06 Software Error	Gene software error (IST, standby): PM calibration task problem	073/009
E06 Software Error	Gene software error (IST, standby): PM calibration task problem	073/010
E06 Software Error	Gene software error (IST, standby): PM calibration task problem	073/011
E06 Software Error	Gene software error (IST, standby): PM calibration task problem	073/012
E06 Software Error	Gene software error (IST, standby): mA measurement calibration problem	073/017
E06 Software Error	Gene software error (IST, exposure): unknown exposure end	074/001
E06 Software Error	Gene software error (IST, exposure): unknown exposure status	074/004
E06 Software Error	Gene software error (MNT): anode stater speed impossible	075/010
E06 Software Error	Gene software error (MNT): anode stater anormal test task status	075/011
E06 Software Error	Gene software error (MNT): heater: impossible track	075/020
E06 Software Error	Gene software error (MNT): heater: abnormal test task status	075/021
E06 Software Error	Gene software error (MNT): heater: abnormal test task status	075/022
E06 Software Error	Gene software error (MNT): bias: abnormal test task status	075/030
E06 Software Error	Gene software error (MNT): HV test: abnormal test task status	075/040
E06 Software Error	Gene software error (MNT): gate test: abnormal test task status	075/041
E06 Software Error	Gene software error (MNT): inverter test: abnormal test task status	075/042
E06 Software Error	Gene software error (MNT): mA value: abnormal test task status	075/050
E06 Software Error	Gene software error (MNT): mA measurement: abnormal test task status	075/051
E06 Software Error	Gene software error (MNT): grid sync: abnormal test task status	075/060
E06 Software Error	Gene software error (MNT): PM test: abnormal test task status	075/070
E06 Software Error	Gene software error (MNT): PM test: abnormal test task status	075/071

CONSOLE MESSAGE	MEANING OF CODE	CODE
E06 Software Error	Gene software error (MNT): PM test: measurement timeout	075/072
E06 Software Error	Gene software error (MNT): error codes: display problem	075/090
E06 Software Error	Gene software error (MNT): error codes: display problem	075/091
E06 Software Error	Gene software error (MNT): error codes: display problem	075/092
E06 Software Error	Gene software error (MNT): error codes: display problem	075/093
E06 Software Error	Gene software error (MNT): transfer: frame code error	075/100
E06 Software Error	Gene software error (MNT): transfer: abnormal transfer task (save) status	075/101
E06 Software Error	Gene software error (MNT): transfer: abnormal transfer task (save) status	075/102
E06 Software Error	Gene software error (MNT): transfer: abnormal state transfer task (load) status	075/103
E06 Software Error	Gene software error (MNT): transfer: abnormal state transfer task (load) status	075/104
E06 Software Error	Gene software error (MNT): transfer: unknown frame	075/105
E06 Software Error	Gene software error (MNT): transfer: end of loading error	075/106
E06 Software Error	Gene software error (MNT): transfer: abnormal tranfer task (protocol) status	075/107
E06 Software Error	Gantry software error (MNT): light anormal test task status	075/110
E06 Software Error	Gantry software error (MNT): rotation anormal test task status	075/111
E06 Software Error	Gantry software error (MNT): elevator anormal test task status	075/112
E06 Software Error	Gantry software error (MNT): display anormal test task status	075/113
E06 Software Error	Gantry software error (MNT): emergency switch anormal test task status	075/114
E06 Software Error	Gantry software error (MNT): compression anormal test task status	075/115
E06 Software Error	Gantry software error (MNT): filter anormal test task status	075/116
E06 Software Error	Gantry software error (MNT): led anormal test task status	075/117
E06 Software Error	Gene init tests software error: timeout on system task	078/002
E06 Software Error	Gene init tests software error: defective function will self_identify	078/003
E06 Software Error	Gene init tests software error: defective function will self_identify	078/004
E06 Software Error	Gene init tests software error: defective function will self_identify	078/005
E06 Software Error	Gene init tests software error: error following VRTX request	078/128

ERROR LIST

CONSOLE MESSAGE	MEANING OF CODE	CODE
E05 Failure during Exposure	Exposure aborted: Heater fault, heat–Ok signal goes ”low” during exposure	079/001
E05 Failure during Exposure	Exposure aborted: anode starter fault, Starter_Ok signal goes ”low” during exposure	079/002
E05 Failure during Exposure	Exposure aborted: anode starter fault	079/003
E05 Failure during Exposure	Exposure aborted: power fault	079/004
E05 Failure during Exposure	Exposure aborted: generator fault	079/005
E05 Failure during Exposure	Exposure aborted: no synchro grid signal detected	079/007
E05 Failure during Exposure	Gantry fault detected before start of exposure	079/008
E05 Failure during Exposure	Exposure aborted: Sync_Grid signal goes “low” during exposure	079/009
E05 Failure during Exposure	Gene (IST, exposure): heater fault, Heat_Ok signal goes ”low” during exposure	080/001
E05 Failure during Exposure	Gene (IST, exposure): anode starter fault, Starter_Ok signal goes ”low” during exposure	080/002
E05 Failure during Exposure	Gene (IST, exposure): power failure	080/003
E05 Failure during Exposure	Gene (IST, exposure): interface fault	080/004
E05 Failure during Exposure	Gene (IST, exposure): grid failure or filter failure	080/007
E05 Failure during Exposure	Gene (IST, exposure): no signal Sync_Grid	080/008
E05 Failure during Exposure	GENE (IST, exposure): Sync_Grid signal goes “low” during exposure	080/009
E06 Software Error	Gene: ’Endurance’ error code	082/000
E06 Software Error	Gene: ’Endurance’ error code	082/001
E06 Software Error	Gene: ’Endurance’ error code	082/010
E06 Software Error	Gene: ’Endurance’ error code	082/020
E06 Software Error	Gene: ’Endurance’ error code	082/030
E06 Software Error	Gene: ’Endurance’ error code	082/040
E14 CPU or INTERFACE Failure	Generator : PROM checksum error.	090/000
E14 CPU or INTERFACE Failure	Interface: reset error	101/001
E14 CPU or INTERFACE Failure	Interface: read/write error on timer PTM3 (U28)	101/002
E14 CPU or INTERFACE Failure	Interface: read/write error on timer PTM3 (U28)	101/003
E14 CPU or INTERFACE Failure	Interface: read/write error on timer PTM4 (U29)	101/004
E14 CPU or INTERFACE Failure	Interface: read/write error on timer PTM4 (U29)	101/005
E14 CPU or INTERFACE Failure	Interface: interrupt error on DUART1	101/006

CONSOLE MESSAGE	MEANING OF CODE	CODE
E14 CPU or INTERFACE Failure	Interface: PTM3 (U28) timer 1 defective	101/007
E14 CPU or INTERFACE Failure	Interface: PTM3 (U28) timer 2 defective	101/008
E14 CPU or INTERFACE Failure	Interface: PTM3 (U28) timer 3 defective	101/009
E14 CPU or INTERFACE Failure	Interface: PTM4 (U29) timer 1 defective	101/010
E14 CPU or INTERFACE Failure	Interface: PTM4 (U29) timer 2 defective	101/011
E14 CPU or INTERFACE Failure	Interface: PTM4 (U29) timer 3 defective	101/012
E14 CPU or INTERFACE Failure	Interface: interrupt error on PTM3 (U28) timer1	101/013
E14 CPU or INTERFACE Failure	Interface: interrupt error on PTM3 (U28) timer2	101/014
E14 CPU or INTERFACE Failure	Interface: interrupt error on PTM3 (U28) timer3	101/015
E14 CPU or INTERFACE Failure	Interface: interrupt error on PTM4 (U29) timer1	101/016
E14 CPU or INTERFACE Failure	Interface: interrupt error on PTM4 (U29) timer2	101/017
E14 CPU or INTERFACE Failure	Interface: interrupt error on PTM4 (U29) timer3	101/018
E14 CPU or INTERFACE failure	Interface: Gantry power validation failure	101/019
E06 Software Error	Gantry software error: unknown task code of safety tube signal	105/014
E06 Software Error	Gantry software error: unknown task command (light centering)	105/017
E06 Software Error	Gantry software error: unknown task command (compression)	105/021
E06 Software Error	Gantry software error: unknown compression pedal status	105/023
E06 Software Error	Gantry software error: unknown status code of compression adjustment presence	105/024
E06 Software Error	Gantry software error: unknown task command (filter wheel)	105/035
E06 Software Error	Gantry software error: unknown task command (filter wheel)	105/036
E06 Software Error	Gantry software error: unknown task code of cassette presence signal	105/037
E06 Software Error	Gantry software error: unknown task code of bucky format signal	105/038
E06 Software Error	Gantry software error: unknown task code of magnification signal	105/039
E06 Software Error	Gantry software error: unknown task code of grid presence signal	105/040
E06 Software Error	Gantry software error: unknown task command (column up/down)	105/050
E06 Software Error	Gantry software error: unknown column command button status code	105/051
E06 Software Error	Gantry software error: unknown task command (compression arm rotation)	105/053
E06 Software Error	Gantry software error: column:unknown task status	106/002
E06 Software Error	Gantry software error: column:VRTX error	106/003

CONSOLE MESSAGE	MEANING OF CODE	CODE
E06 Software Error	Gantry software error: column:unknown order transmitted to task	106/004
E06 Software Error	Gantry software error: compression:unknown task status	107/002
E06 Software Error	Gantry software error: compression:VRTX error	107/003
E06 Software Error	Gantry software error: compression:unknown order transmitted to task	107/004
E06 Software Error	Unknown status code of collimator configuration	108/001
E06 Software Error	Gantry software error: filter wheel:VRTX error	112/000
E06 Software Error	Gantry software error: filter wheel:unknown task status	112/001
E06 Software Error	Gantry software error: filter wheel:unknown task status	112/002
E06 Software Error	Gantry software error: filter wheel:unknown task status	112/003
E06 Software Error	Gantry software error: filter wheel: unknown task status	112/004
E06 Software Error	Gantry software error: filter wheel: unknown order transmitted to task	112/005
E06 Software Error	The task t_filter received a request for an unknown filter	112/013
E06 Software Error	Gantry software error: light centering:unknown task status	114/002
E06 Software Error	Gantry software error: light centering:VRTX error	114/003
E06 Software Error	Gantry software error: light centering:unknown order transmitted to task	114/004
E06 Software Error	Gantry software error: rot. brake:unknown task status	121/002
E06 Software Error	Gantry software error: rot. brake:VRTX error	121/003
E06 Software Error	Gantry software error: rot. brake: unknown order transmitted to task	121/004
I72 Column Motion Failure	Elevator: mechanical end of travel or actual speed fair times less than speed reference.	156/005
I72 Column Motion Failure	Elevator: upper mechanical end of travel reached during a downards movement.	156/006
I72 Column Motion Failure	Elevator: lower mechanical end of travel reached during a upwards movement.	156/007
I72 Column Motion Failure	Column: Both end of travel sensors are closed	156/008
I72 Column Motion Failure	Column: signal Elev_Soft_Pres too long in ’low’ status	156/010
I72 Column Motion Failure	Column: signal Elev_Soft_Pres too long in ’high’ status	156/012
I72 Column Motion Failure	Column: Signal (Elev_Soft_Pres & Oper_Pres_Sw &Valid_Elev_On)=1 & Elev_State_Off & Elev_On = 1 while the current in elevator motor is correct (signal Eleve_state_off remains high if there is not enough current in elevator motor)	156/013
I72 Column Motion Failure	Column: signal (Elev_Soft_Pres & Oper_Pres_Sw & Valid_Elev_On) =1 & Elev_On = 0 & Elev_On=0 & Elev_State_Off=1	156/014

CONSOLE MESSAGE	MEANING OF CODE	CODE
I72 Column Motion Failure	Column: signal (Elev_Soft_Pres & Oper_Soft _Pres & Valid_Elev_On) = 0 & Elev_On = 1 & Elev_State_OFF = 1	156/015
K50 Column Fail > Power Shutdown	Column Power shutdown, uncontrolled movement, Signal Elev_On = 0 & Elev_State_Off = 0	156/016
K50 Column Fail > Power Shutdown	Column: Power shutdown: uncontrolled movement: Signal Elev_State_Off = 0 during init during elevator software init	156/018
I72 Column Motion Failure	Colum: Signal Elev_On = 1 during elevator software init	156/019
I72 Column Motion Failure	Column: direction of movement is opposite to the desired direction (up)	156/020
I72 Column Motion Failure	Column: Max speed with stop command during down movement	156/021
I72 Column Motion Failure	Column: direction of movement is opposite to the desired direction (down)	156/020
K50 Column Fail > Power Shutdown	Column: Uncontrolled movement: (signal Elev_Soft_Pres & Oper_Soft_Pres & Valid_Elev_On) = 0 & Elev_On =1 & Elev_State_Off = 0	156/023
E72 Column Motion Failure	Column: Safety: Elevator cable cut	156/026
I72 Column Motion Failure	Column: CFEM out of range	156/027
I72 Column Motion Failure	Column: CFEM out of range in steady state	156/028
I72 Column Motion Failure	Column: Nil time for CFEM calculation during init	156/030
I72 Column Motion Failure	Column: Nil time for CFEM calculation	156/031
E70 Compression Failure	Compression: abnormal force frequency	157/005
E70 Compression Failure	Compression: signal Comp_On 'high' during init	157/006
E70 Compression Failure	Compression: Security_Comp test fails	157/008
E70 Compression Failure	Compression: signal Comp_On & Comp_State_Off both 'low'	157/009
E70 Compression Failure	Compression: signal Comp_On & Comp_State_Off both 'high'	157/010
E70 Compression Failure	Compression: R/W error during init in the command register of compression	157/011
E70 Compression Failure	Compression: Measured force > 30 daN	157/012
E71 Compression Adjustment Failure	Compression: adjustment: signal 'Pres_Adjust' too long in 'Low' status	157/014
E71 Compression Adjustment Failure	Compression: adjustment: signal 'Pres_Adjust' too long in 'High' status	157/015
I70 Compression Failure	Compression Hardware Failure: thickness computation out of range	157/024
I70 Compression Failure	Compression Hardware Failure: thickness potentiometer frequency out of range	157/025

CONSOLE MESSAGE	MEANING OF CODE	CODE
I70 Compression Failure	Compression: Unstability between two computations of thickness (Too high differences between both measures)	157/026
I70 Compression Failure	Compression: Paddle motion detected without thickness modication	157/027
I70 Compression Failure	Compression: Thickness modification without paddle motion	157/028
E51 Collimator Failure	Collimator: Opto electronic sensors failure	158/017
E64 Filter Positioning Failure	Filter wheel: step number error between two references	162/006
E64 Filter Positioning Failure	Filter wheel: step number error between two references	162/007
E64 Filter Positioning Failure	Filter wheel: step number error between two references	162/008
E64 Filter Positioning Failure	Filter wheel: step number error between two references	162/009
E64 Filter Positioning Failure	Filter wheel: step number error between two references	162/010
E64 Filter Positioning Failure	Filter wheel: no reference crossing during rotation	162/011
E64 Filter Positioning Failure	Filter wheel: in standby, wheel moved from stable position	162/012
I55 Light Centering Device Fail	Light centering device: signal Light_Fail is in wrong state	164/001
I73 Rotation Brake Failure	Arm rot. brake: signal Rot_Soft_Pres too long in ’low’ status	171/005
I73 Rotation Brake Failure	Arm rot. brake: signal Rot_Soft_Pres too long in ’high’ status	171/006
I73 Rotation Brake Failure	Arm rot. brake: (Rot_Soft_Pres & Oper_Pres_Sw & Valid_Rot_On)=1 & Rot_On=1 & Rot_State_Off=1	171/007
I73 Rotation Brake Failure	Arm rot. brake: (Rot_Soft_Pres & Oper_Pres_Sw & Valid_Rot_On) =1 & Rot_On = 0 & Rot_State_Off = 0	171/008
I73 Rotation Brake Failure	Arm rot. brake: (Rot_Soft_Pres & Oper_Pres_Sw & Valid_Rot_On)=0 & Rot_On=1 & Rot_State_Off=1	171/009
K52 Rotat. Fail > Power Shutdown	Power shutdown: uncontrolled movement risk (arm brake); Rot_State_Off & Rot_On are ’low’”	171/010
K52 Rotat. Fail > Power Shutdown	Power shutdown: uncontrolled movement risk (arm brake); Rot_State_Off ’low’ during elevator software init	171/012
I73 Rotation Brake Failure	Arm rot. brake: signal Rot_On ’high’ during elevator software init	171/013
K52 Rotat. Fail > Power Shutdown	Power shutdown: uncontrolled movement risk (arm brake); (Rot_Soft_Pres & Oper_Pres_Sw & Valid_Rot_On)=0 & Rot_On=1 & Rot_State_Off = 0	171/014
I73 Rotation Brake Failure	Brake temperature too high	171/015
I73 Rotation Brake Failure	Hard Failure, angle potentiometer frequency out of range	171/016
I73 Rotation Brake Failure	Unstability between two computations of angle (Too high differences between both measures)	171/017
I69 Magnification Failure	Hardware failure: Magnification sensor: unknown magnification code	172/003

CONSOLE MESSAGE	MEANING OF CODE	CODE
I75 Button Security Failure	Hardware failure: Button interlock: signal Oper_Pres_Sw too long in ’high’ status	172/009
I75 Button Security Failure	Hardware failure: Button interlock: signal Oper_Pres_Sw too long in ’low’ status	172/010
E07 Switch Off	Hardware failure: Emergency stop failure	172/040
E07 Switch Off	Hardware failure: Switch off failure	172/041
I77 Comp Pedal Security Failure	Compression Hardware Failure: one pedal pressed and signal Foot_Sw_Pres ’low’	172/055
I77 Comp Pedal Security Failure	Compression Hardware Failure: no pedal pressed and signal Foot_Sw_Pres ’high’	172/056
E74 Fan failure	Hardware failure: Fan Failure	172/057

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